Towards a learning organisation

Reviewing technologies for company training

Mathy Vanbuel

in cooperation with Annemie Boonen

and Jean Joseph Scheffknecht

The TIDE project examines the use of information and communication technologies for vocational training. It explores issues such as resources, management and added value, from both a technological and an educational perspective.

The documents and activities illustrate the current status of technology and of the policy makers' outlook, and pertain to the broader context of tailor-made training for the learning company and organisation.

This project concerns experts, decision makers, as well as the users of these training technologies.

Information Technologies for the Learning Organisation

Towards a learning organisation

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We tried to quote correctly from all case studies, references and resources and to solve all copyright issues. If any mistakes were made or if any persons entitled feel unhappy with our use of the material, we urge them to contact us.

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Introduction

To whom is this handbook addressed?

This book is intended for those people in companies and organisations who are interested or involved in the development or implementation of new learning and training technologies. It is directed towards decision-makers in training and Human Resource Management (HRM) departments and those involved in the provision of training in Small and Medium Sized Enterprises (SMEs) as well as in corporate and public organisations. While trainers and tutors will find neither ready-made learning materials nor off-the-shelf solutions for delivering courses they may find it useful for ideas and suggestions about the way in which Information and Communication Technologies (ICT*) can be further used in training.

Why this handbook? Development in education and training methodology as well as in the technology of Information and Communication Technologies (ICT) allow trainers, teachers and tutors to adopt new styles of training. It also allows them to choose more appropriate applications to deliver their training courses: flexible in time, in place, personalised, reusable, adapted to specific domains, etc. It can also be used to provide training more cost-efficiently. IBM for example estimate that for every 1,000 classroom days converted to electronic courses delivered via the web, more than 400,000 EURO can be saved. In the year 2000 the company expects 30 % of its internal training materials to be delivered online* with anticipated savings of more than 120 million EURO [1].

[1] Business Week EBIZ - cover story, How IBM uses the Net, December 1999.

The purpose of this handbook is to provide you with a guide through the increasingly complicated landscape of training applications. It will serve as a kind of 'road map'. That means that we will show you various routes to reach your goal. We cannot show you all of them, since we know neither your starting point nor the vehicle in which you will travel, however we will indicate various attractions along the way, give an estimate of their cost, as well as alternatives, and so on. We hope the handbook will help you make important decisions, such as whether to buy in materials or develop your own.

This handbook is intended as an instrument that can help when you need to make decisions about implementing Information and Communication Technologies (ICT) for training. These decisions are rarely taken in isolation, it is our experience that a company's general policies with regard to ICT will have important strategic impact on the way ICT is used for training purposes and we have tried to take this into account in writing this handbook.

What methodology has been used?

Rather than being overly theoretical and exhaustive, we have tried, as far as possible, to ensure that this book is comprehensive and interesting. We have also tried to point to other sources should the reader wish to find out more about particular applications that are of interest to him/her. This includes references to various working case studies that are quoted at different stages in the handbook.

We have divided it into chapters that broadly correspond to the main generic applications. Each chapter contains: 1) a generic description of the application and aspects of it that relate specifically to the training environment; 2) a list of the various implications implicit in choosing in favour of that application. By implications we mean that we try to indicate what the usual consequences are on the internal policy or culture of an organisation or company should they implement such an application for training purposes. We also try to point out consequences for the trainers, tutors, course developers, learners and trainees, the level of adaptation

required from all involved and so on. Where this is possible, we also try to indicate the foreseeable effects on work, efficiency, cost, etc. Furthermore we try to give you indications regarding the cost implications for all involved, as well as suggestions and ideas on issues such as when you might consider subcontracting, what investment is necessary or useful. In some cases, we have added in suggestions for making the best use of the application being described; 3) one or more short case studies illustrating how such an application has been used in 'real life'; 4) as an aid to decision-making, we have added an indication of the apparent advantages and disadvantages of each application with a handy checklist of questions you should consider. We suggest you take the time to read through this checklist viewing it as a kind of practical exercise. If you are having trouble understanding any of the questions asked you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answers to these questions, then you probably need to consult with one or other of your colleagues. Within the Tide Adapt-Bis project, a level of expertise has been reached whereby you might find contacting one of the project team members useful, as they may be able to help you in your implementation plans. The Tide Adapt-Bis project is responsible for the creation of this handbook (http://projects.europace.be/tide/).

At the end of this handbook you will find two useful appendices, first of all a resource, reading and reference list providing further useful sources of information and then an extensive glossary covering many of the terms used in Information and Communication Technologies (ICT*)-based learning.

As a device to aid the reader, we have used a format where boxes such as the following are used to provide information, which in general terms while not vital for a full understanding of the application, come under the category of 'nice to know'.

List servers and distribution lists

When e-mail is addressed to a list server, it is automatically sent to everyone who subscribed his/her e-mail address to that list. The result is similar to a Bulletin Board System or Newsgroup*, except that the messages are transmitted as e-mail and therefore available...

Words that are further explained in the handbook glossary are indicated with an * when they appear in the text as follows.

An example: one such (or even the most) confusing expression is the frequently used term 'Internet*-based training'.

Disclaimer

There is no one correct way to write a handbook such as this. It is also important to point out that our approach may differ significantly from that of others tackling the same field of new learning technologies. This is because many other handbooks focus on different divisions or types of learning applications. Some, in our humble opinion, complicate issues by mixing learning applications with methodologies for transmission or telecommunications devices on which they are based. An example: one such (or even the most) confusing expression is the frequently used term 'Internet*-based training'. When using the term Internet according to its definition

as the 'network of networks, linking computers to enable exchange of information', then the term 'Internet-based education or training' makes no clear sense to any user. It is rather the shape in which the information is moulded that defines the training application. 'Internet-based' can therefore mean electronic distribution of text-based materials (i.e. Electronic Publishing), e-mail* or computer-conferencing applications or WWW*-based applications. In some situations videoconferencing* can take place over the Internet and even video and audio-based materials can be distributed (netcast*) via the Internet. The Internet covers too many applications and as such does not stand for one particular training application or approach.

The Internet

The Internet is the largest network of interconnected computer networks in the world. A formal definition is an inter-network of networks which utilise the Transfer Control Protocol/Internet Protocol (TCP/IP*) network protocol*, and in which domain names* are under the ultimate control of institutes such as RIPE, InterNIC or APNET.

The Internet takes its name from inter-network, the technical term used to describe a group of computer networks linked together by routers*. It was created in the early 1960s as a scientific-academic network financed by the US military and known as DARPANet. The Internet has in the last five years evolved rapidly as an academic and commercial network. Although estimates vary considerably, the Internet is currently thought to link more than 179 million users to some 56 million hosts* (June 1999). (As a comparison, there are currently 950 million telephone terminations.)

Based upon the set of packet switching protocols known as TCP/IP, the Internet provides the framework for applications such as global e-mail messaging across network boundaries, the distributed multimedia* client/server* system that is the World Wide Web and a number of lesser-known services such as File Transfer (FTP*).

The dangers and disadvantages of the Internet

There are a number of facets of the Internet that give rise to concern and disadvantage in a business context, namely:

- Users express concerns about the risk of security breaches, either of transitory information (e.g. of an e-mail as it is transmitted across the Internet), and of their own computer systems in terms of unauthorised access to data or system functionality.
- In essence the nature of the Internet does not guarantee any quality of service (QoS*) such as that provided by the telephone network; this is one of the major drawbacks of the Internet. It means that at any given moment you may be able to receive your e-mails at high speed, while at another time e-mails may come in slowly, access to a web site may be fast and fluent at certain times of the day and slow at others. Applications that are synchronous* or that need a continuous data flow such as audio (e.g. telephony) and video (e.g. videoconferencing) can therefore be performed much more reliably via other data communications systems such as the telephone line (analogue* or digital*).
  The latter may cost significantly more but will offer a guaranteed QoS on demand (at the time you request the service). This guarantee is not yet available on the Internet.
- The relatively unstable and unplanned nature of bandwidth* availability on the Internet tends to preclude high-bandwidth applications. Experience shows that to date, services such as video-on-demand* or videoconferencing on the Internet, which require high bandwidth, are not yet mature.
- There are also questions with regard to the quality and/or accuracy of information found via the Internet, and especially on the World Wide Web. Because of its public self-regulatory nature and open structure the World Wide Web allows everyone to become a publisher, whether he/she has

So, what we have tried as far as possible to do is to broadly divide the chapters according to applications, i.e. what you do with the technology. This is in line with the fact that trainers and learners rarely choose a delivery mechanism; usually what happens in our experience is that they choose a methodology or application. It is not always easy to clearly achieve this and some overlap does occur which we have tried to explain as we go along.

It is also important to point out that a handbook such as this can never be truly up to date or complete, such is the nature of publishing. We have tried as far as possible to avoid naming very specific products but have tried rather to point to generic aspects of each of the applications and provide further points of information where this is useful. The nature of this industry is changing daily: yesterday's market leaders are today's has-beens, so it is important that the decision-maker chooses standardised, future-proof applications, products and services where possible, and we have tried to focus on these aspects where appropriate.

A number of important specialist issues such as network security, electronic content identification, commercialisation of content and Intellectual Property Rights (IPR) are not covered extensively but rather touched upon where necessary and when useful in the discussion. In the further reading section, some pointers are given to resources which provide further information about these issues.

Finally one brief word about electing for multiple applications, sometimes called the 'media mix'. We have tried to discuss each of the generic applications separately. In our experience however, we have found that it is rare for a company to choose exclusively in favour of one application, but rather a media mix that includes a number of different applications. What normally happens, and what seems to be the most successful approach, is that successful users of ICT in training select a mix of technologies, carefully blending them with each chosen according to its specific strengths to meet particular training challenges. You will see this from the case studies quoted.

something useful or of quality to offer. Impressive web sites do not necessarily reflect the size and importance of a company and vice versa.

- E-commerce (or commerce via the Internet) and B2B (business to business applications) have been slow to take off. This however is now changing gradually thanks to increasing self-regulation and the implementation of security mechanisms on the Internet.
- Owing to the rapid development of the Internet and its technologies, there exists some measure of uncertainty as to the validity and permanence of standards. This is especially the case with regard to new developments of the Internet, where not only the standards for the basic web interface* (HTML*) but also different implementations of what are essentially similar technologies predominate. A typical example of this is the difference in behaviour between Internet Explorer and Netscape Navigator, the two most common web browsers*. While both are compliant to the basic standards, they will each treat new technology developments such as Dynamic HTML* differently.
- While the Internet continues to grow, and the media used across the Internet increasingly consist of bandwidth-hungry graphical and multimedia applications, questions must be asked about the cost of infrastructure development. Pricing models of Internet use are diversifying: costs can be flat rate (e.g. traditional dial-up* access), based on bandwidth used (e.g. cable network* modem* connection), based on data downloaded* (e.g. in ADSL* connections) or based on a combination of all three (e.g. Internet via satellite).

Table 1: the Internet

After reading this handbook

Once you have read through this handbook, our hope is that you will better understand which applications best fit your own situation. Furthermore we hope that you will have a clear idea of the implications inherent in choosing a particular application or group of applications. It will also give you some ideas on where you can find further information and good working examples of various different applications. We hope it will also clarify what resources you need to develop inside your own company as opposed to those which are probably best subcontracted.

Foreword

Network infrastructure

Before beginning the handbook, we would like to spend a short amount of time presenting the various network infrastructure options that are usually available to companies in their implementation of an ICT*-supported learning environment. Throughout the handbook, we will be referring to networks and so it is important to fully understand the various options that are available as well as those which look set to be available in the near future. The kind of network that you have available for connecting your trainees with the trainer and with one another will play a large part in dictating the kind of application you choose for the delivery of training to your target audience. Therefore it is important to find out what network your company has available and what its plans are for the development of its networks in the near future. Such information gathering will require you to be in close contact with your company's network manager and his or her staff who provide network support to the company. Such contact will be of great benefit in that it allows you access to the people who can help you decide whether or not certain applications are possible in the development of your training network. The same people will help you in the implementation of your training network. Therefore it is really important to have them 'on board' at the earliest possible opportunity.

In fact it is rare for training within a company to operate on a network other than the one used for existing company communications. It is thus of the greatest importance to identify or build training applications that make the most out of the existing ICT* infrastructure within your company without overloading the network and its terminals, ensuring that regular business traffic and operations are not put at risk. By working closely with the network and ICT management of the company in the development of your training plans, you will be assured of the necessary support to keep your applications running smoothly. This will also ensure that your network can develop in line with the company's network development plan and without the need to invest in separate technology and technical management and operations. By showing your department's strong interest in the network infrastructure of your company, you can help plan for the long-term information and communication needs of your organisation, including training.

Network infrastructure options

A lot of confusion exists in relation to the topic of network infrastructure; some network names are used synonymously with the underlying infrastructure on which they operate, while others can run on any one of a number of different infrastructures.

Network infrastructures encompass all communication networks (formal and informal) within an organisation. A network infrastructure comprises the logical and physical interconnection of all networked resources including: telephone networks, fax machines, computers, local area networks, wide area and wireless network systems, as well as all common files, databases and shared information systems used within an organisation. The term is often used in facilities management to describe the management and planning of an organisation's electronic communications needs.

The physical network infrastructure of an organisation includes the various forms of computer and communications networks used within an organisation, for example Local Area Networks (LAN*), Private Branch Exchange (PBX*) systems, and Wide Area Networks (WAN*), etc.

Logical network infrastructures take into account the logical communications network of an organisation including mobile telephony and data systems. Logical network infrastructures are primarily concerned with how information flows through a network (including information flow over physical network boundaries) from one user to another.

The following lists the most common network components available to training managers.

Public Switched Telephone Network (PSTN)

Public Switched Telephone Network (PSTN) describes the everyday telephone network used for the transmission of voice conversations and fax images, and for low-speed data transmission. A PSTN network comprises the telephone equipment in homes and offices, the switching and multiplexing systems at exchanges and the trunk connections between exchanges. A PSTN telephone in the home or office is typically attached to a twisted pair of conducting copper wires, called the local loop.

Public Switched Telephone Network (PSTN)
A local loop connects a telephone to the nearest exchange. The exchange, which can house both multiplexing and call switching circuitry, connects to other exchanges via trunk connections. A trunk connection can consist of a co-axial cable*, optical fibre*, microwave* or satellite links, etc. The PSTN infrastructure is primarily used for the delivery of voice services and is increasingly used as a means for access of the Internet over a simple dial-up connection* to an Internet Service Provider (ISP*). There are an estimated 560 million PSTN local loop connections worldwide, representing considerable investment by telephone organisations, governments and individuals. The PSTN market place for information services (dial-up Internet connection, video-on-demand*, etc.) is vast and is witnessing substantial effort to provide higher-speed digital* services (e.g. ISDN*, ADSL*, etc.) over the existing networks. PSTN infrastructures are often older installations that have limited bandwidth* capacity when compared to services offered by innovative services such as cable television. Current single twisted-pair local loops are used either in a Plain Old Telephone Service (POTS) configuration providing just 3.6 kHz of analogue* bandwidth, or as ISDN providing 128 kbps. Neither of these can transmit full-screen colour moving pictures (e.g. films).

Table 2: PSTN

Integrated Services Digital Network (ISDN)

The Integrated Services Digital Network (ISDN) is a relatively fast digital phone line complemented with a complex arrangement of standards developed in reaction to the growth in demand for non-voice telecommunications services. At the level of the consumer, ISDN is the most profound development of the telephone system since automatic switching replaced the human operator. ISDN provides telephone-based end-to-end digital connectivity, and a framework for the deployment of a new generation of integrated services for voice, fax, video and data communications.

Integrated Services Digital Network (ISDN)

ISDN is an international standard for global digital communications networks developed by the International Telecommunications Union (formerly known as CCITT*) between 1984 and 1989. ISDN is based upon an extended form of the Public Switched Telephone Network (PSTN). ISDN services can be delivered over standard twisted-copper-pair local loop networks.

An ISDN line is normally described as having two types of channel, a bearer channel (B-channel) and a data channel (D-channel). B-channels are circuit-switched (the whole connection is switched to one destination, the same as a standard telephone call). They are the prime carrier for digital voice and data services and have a transmission capacity of 64 kbps. D-channels (data) are packet-switched data channels and operate at capacities between 16 kbps (for basic-rate ISDN) or 64 kbps (for primary-rate ISDN). Telecommunications companies worldwide offer two different forms of ISDN service, termed basic-rate ISDN and primary-rate ISDN. Basic-rate ISDN is usually considered to have a total capacity of 128 kbps. Primary-rate ISDN provides 30 B-channels and one D-channel.

Basic-rate ISDN is now commonplace for dial-up* internet connections, while primary-rate ISDN is very commonly used to connect to larger organisations. It is reasonable to expect that telecommunications companies will eventually phase out traditional analogue* phone lines, making basic-rate ISDN the entry level, although the timescale for this must be in question. As a digital service network ISDN is faster than traditional PSTN systems due both to the mechanisms of connection and the increased bandwidth: a typical analogue modem* call needs 30 to 60 seconds to establish a connection, while an ISDN connection will take 1-3 seconds.

ISDN also provides better scalability and switching than traditional analogue lines; in particular, the carrying capacity of B-channels can be supplemented to provide more throughput for a single connection. This is an especially useful way of providing adaptive bandwidth (bandwidth on demand). The main business disadvantages for the widespread use of ISDN are the pricing structures of telecommunications providers, which differ widely throughout Europe and which can be prohibitive in some countries. This has resulted in ISDN being perceived as a complicated, expensive telephone service. It should also be noted that in the USA, Japan and some other non-European countries, ISDN has a different bit* rate. This places a constraint on the speed of connection with terminals in these countries. A valid criticism of ISDN is that it is an old technology, already superseded by new PSTN technologies such as ADSL. It is questionable why consumers should be expected to be happy with a 128 kbps* limit to twisted-pair wiring across which ISDN operates, when ADSL would seem to have the capacity to place more than 2 Mbps over the same wire.

Table 3: ISDN

Asymmetrical Digital Subscriber Line (ADSL)

Asymmetrical Digital Subscriber Line (ADSL) is a method of sending data at high speed over existing PSTN copper twisted-pair telephone wires. ADSL is capable of providing a high-speed, uni-directional data channel at up to 8 Mbps* (enough for

compressed full-motion, full-colour movies) or a bi-directional duplex data channel with transmission speeds up to 5.76 Mbps. These channels can be subdivided in many ways to provide several simultaneous service supports for existing analogue* telephone services including voice and fax. A number of variants of ADSL exist. It is best suited to applications that need high bandwidth* from the provider or telephone company to the user and relatively low bandwidth from user to provider. As a result, typical services planned for ADSL-based communications networks include video-on-demand and high-bandwidth 'Internet* to the home'. ADSL is less suited to applications such as videoconferencing*. This is because videoconferencing requires balanced, symmetric and simultaneous amounts of data to be sent in both directions, which ADSL does not allow. Telephone calls can still be made and received while the system is used for high-bandwidth applications. The competing cable networks* employ a combination of optical fibre* and co-axial cable* that is capable of providing local loop bandwidth of up to 1 Gbps. At the subscriber end the cost of ADSL modems are comparable with the costs of cable network television modems (between 200 and 500 EURO typically).

Leased lines or leased circuits

A leased line or leased circuit is a telephone line that has been leased by an organisation for private use. Leased circuits are permanently open connections, unlike conventional telephone connections that are not open unless a call is manually initiated. A leased circuit provides a method of implementing a permanently open and often high-bandwidth connection between two specific geographic locations. It is a common way to link an organisation to an Internet Service Provider (ISP*) or in the development of wide area networking solutions where large volumes of data traffic or business requirements make transient connections such as access via a telephone unfeasible. Leased circuits add to the fixed costs of organisations, and in remote locations will normally cost rather a lot. Cost is determined by distance, time and bandwidth and will be calculated for your situation by your local telecom operator. Leased circuits can be leased in scaleable sizes (usually from 64 kbps to 2 Mbps and more in steps of 64 kbps).

Cable networks

Cable networks, also called Cable TV or CaTV, are communication networks that typically deliver television services to commercial and domestic users via co-axial or optical fibre cabling. Cable networks have existed since the 1950s. Cable networks work on the principle of broadcasting signals through cable to set-top boxes (decoders) at the subscriber's premises. The first cable networks allowed signals to be transmitted in only one direction. New cable networks implementations are mostly bi-directional and where commercially viable uni-directional cable networks will be upgraded. Cable networks are increasingly of importance as a carrier of information society applications. Modern cable networks provide higher bandwidth and bi-directional features, which characterise applications of Internet technology. Modern cable networks currently offer three core services - television, Internet and telephony. Telephony and Internet across cable networks is now a viable low-cost, high-speed communications alternative for commercial and domestic users, often at very competitive rates, but only in places where the cable networks are technically up to date and offer these services.

Satellite networks

Satellite networks employ orbiting satellites in both fixed (geostationary) and dynamic orbits to provide voice, video and data communications and broadcast services. Common business applications for satellite networks include videoconferencing; before the larger uptake of ISDN videoconferencing most international videoconferencing was transmitted via satellite. It also includes business television, live or pre-recorded broadcasts to a narrow group of recipients distributing business information or training programmes as well as data communications using a satellite point-to-point link in order to transport data from one point to another. Used in this manner, satellites are a way to pass information between remote geographical regions where wired network links do not exist or in order to provide additional bandwidth capacity for existing cable infrastructures. Most satellite operators are currently upgrading their networks to enable TCP/IP*-based communications. Satellite networks offer some distinct advantages over wired telecommunications. Point to multi-point transmission makes them ideal for geographically dispersed broadcast television; satellite communication base stations are relatively small and easy to install, making them ideal for providing modern telecommunications for sparsely populated rural areas or for remote locations. Satellite networks offer a high security and privacy level and can provide high bandwidth without having to deal with the saturated terrestrial networks.
The main disadvantages of satellite networks relate to the relatively high costs and technical requirements for deploying and maintaining private satellite systems.

Satellite networks

Geostationary satellites are positioned in a fixed position in the sky where the gravitational force of the earth is exactly countered by the satellite's centrifugal force, causing the satellite to remain exactly above the same point on the earth's surface. The number of geostationary satellites in orbit representing commercial communication, broadcast television, and other interests is large and continuously increasing. Low or middle-earth orbit (LEO or MEO) satellites, on the other hand, reside between 450 and 1,000 km above the earth. Unlike geostationary satellites they do not remain in a fixed position over the earth. In order to achieve global coverage a LEO-based satellite network requires a considerable number of satellites to operate successfully.
Satellite communication systems are based upon microwave communication technology. Each satellite is equipped with a combined transceiver/receiver called a transponder. The transponder receives a signal from a transmitting earth base station (known as an up-link), reprocesses it, amplifies it and retransmits it to receiving stations (known as down-link). Satellites offer a viable solution when the coverage area is extended beyond regional boundaries to a continental or global scale or when services are to be provided in remote and otherwise hard-to-connect regions. Satellite networks support various general applications including communication (voice, radio and video communications), navigation (Global Positioning System (GPS) services), weather and earth sensing, surveillance and video broadcasting (the broadcasting of a number of television channels to a wide area).

Table 4: satellite networks

Conclusion

Each telecommunications network has its own range of specific basic applications, based on its architecture and capacity. The PSTN* or telephone network is best suited for voice and fax communications. By using analogue* modems the telephone network can also be used for transferring low-speed data. ISDN adds to the voice and fax facilities: a higher data transfer rate allowing for better quality data communications and for higher-level services such as videoconferencing. ADSL allows for even higher data rates than ISDN and is therefore best suited for high-speed data communications. The fact that ADSL is asymmetric makes it on the other hand less suitable for services like videoconferencing. ADSL is also not widely available yet. Cable networks allow broadcasting (television as well as data) and when upgraded to two-way add telephone and data communications to their services, allowing for high-speed transfer rates from server* to end-user. Full-functionality cable networks are not available everywhere though. Satellite communications are best suited for broadcast (e.g. television programmes) and for secure, high-speed connections to remote or geographically distributed sites that are otherwise hard to connect in a reliable way.

The following table gives an indication of typical costs in EURO and is based on average prices in Europe. Cost will obviously vary considerably from region to region and according to specific circumstances including availability.

Type	Installation cost	Monthly subscription	Available speed Upload/Download
PSTN	75	25	56K / 33.6K
ISDN	150	25	128K / 128K
ADSL	500	> 50	6M / 300K
Cable	250	50	1M / 32K
Satellite	3000	50	3M / 78K

Table 5: typical network costs (EURO)

Data communications over various networks

With almost every communication application (telephony, videoconferencing, TV, video-on-demand, etc.) switching over to the TCP/IP* protocol*, it is important to understand what this protocol means to the network. TCP/IP or Transmission Control Protocol/Internet Protocol is a networking standard that provides the basis for internet as a technology to connect computers, and by consequence it provides the foundation for the formation of the Internet as a global communications and information network. TCP/IP provides a relatively simple, flexible networking protocol that is capable of supporting file transfer and higher-level protocols such as the HyperText Transfer Protocol (HTTP*), which is the basis of the World Wide Web, and Simple Mail Transfer Protocol (SMTP*), the basis of Internet e-mail*.

TCP/IP has several limitations: the protocol was developed with a minimal concept of Quality of Service (QoS*), which related almost exclusively to guaranteeing that packets of data would reach the destination to which they were dispatched. By consequence many multimedia* applications such as telephony, audio and web TV fail rather miserably as network quality decreases. TCP/IP, being point-to-point,

has no native multicast* facilities. This is disadvantageous since many applications, from the receipt of market and share information through to video broadcasting, are inherently multicast applications. A range of additional protocols and technologies, such as IP Multicast*, the Mbone* and the ReSource reserVation set-up Protocol (RSVP*) have been developed to enable multicast over TCP/IP. Both the Quality of Service and the multicast issue are continuously under development. Bandwidth* is also becoming increasingly available on all networks (by the increase of capacity on individual networks, by increasing the number of physical network lines, by the implementation of more powerful compression* technologies allowing for larger amounts of information to be transmitted in smaller data chunks).
There is, finally, a concern that IP*, as it is now, has an insufficient address space to provide for potential and/or expected uptake, flexibility and granularity. There is a strong expectation that IP is so useful as to become near-ubiquitous in the future, and that in particular it will have a role in controlling all types of devices including the humble light bulb, requiring a huge increase in IP address* availability.

Chapter 1

Video and audio

Introduction

The use of video and audio is probably the best-known and most familiar way in which technology can be used to support learning. In this chapter we will be dealing with both pre-recorded and live video and audio. We will be discussing the various ways they can be distributed, in a traditional broadcast environment, web-cast over the Internet or distributed by post. We will also be discussing some of the ways in which they can be seen to be interactive including 'interactive' television and video-on-demand*. This chapter is fundamental in its own right because it will introduce the basic concept of appropriate use and design of video and audio. This information can then be applied in almost all of the following chapters when discussing the use of multimedia, this being essentially the combined use of text, data, images and sound.

Generic description

The term video is used in many different ways: it can be the making of a video recording, the videotape itself, a television programme or the video-player. In this chapter we will be using the term to indicate moving images - possibly but mostly accompanied by sound - that are electronically captured, processed and re-displayed using either some form of video-recording or direct transmission technologies. This same procedure will be adopted for the term audio: both live generated sound (such as radio and telephone transmitted audio) as well as pre-recorded sound will be addressed in this chapter. Key in the overall process of selecting the video or audio application is the delivery mechanism. Will the audio/video be pre-recorded and distributed using something like a tape, cassette, CD, etc. or will the audio/video be generated live and instantly and synchronously* transmitted to the audience via some direct communication technology (telephone line, Internet, radio waves or satellite)?

Video and audio as training applications

Ever since the invention of radio, TV, video and other image- and sound-capturing technologies, educators have immediately grasped their potential for supporting the teaching and learning process. School radio and school TV were adopted early in many countries to support teachers with additional resources or to complement or replace traditional classroom-based teaching when learners lived too far away to allow for regular classroom attendance. Tape recorders found their way into the classroom to facilitate language teaching. Video recorders and imaging devices were quickly adopted to document topics that could not otherwise be shown. Both video and audio have their intrinsic values as testimonies: the voice and image of the expert that is otherwise impossible to reach, sound recordings of historic speeches, music and drama help involve the learning audience. Appropriate use of music, sound effects and speech (commentary) in video can increase attention and improve intelligibility.

In the same way video (and even graphics and still images) can show events that cannot otherwise be made visible. By time-lapsing the recording, the growth process of plants or the development of a building under construction can be made visible, just like patterns in weather maps or hydrostatics. Slowing down the playback allows the learner to study and analyse fast processes such as movements, explosions, etc.

Moving and still images also allow for the display of events that are otherwise hard to observe: rare medical operations can be shown to surgeons, explosions to engineers, natural phenomena can be visualised, etc. In the same way recordings can be repeated, paused, slowed down, reversed, etc. to make a point. Careful editing can emphasise or visualise relationships or issues that cannot be shown in reality.

Video and especially animation can also help visualise topics such as the behaviour of biological or physical elements that would otherwise remain abstract and hard to understand. They also allow you to record, replay and study for example role-plays or simulations, allowing the trainer to give instant feedback or the trainee to later evaluate his/her own progress. This is especially true in training of communication skills.

Last but not least, both video and audio can involve the learner by conveying emotions and feelings.

Pedagogical implications

Pre-recorded video

Pre-recorded video can convey a richer variety of information than other media such as audio, text or drawings. This capability allows the trainee to learn through both verbal and visual clues, to visualise actual objects and realistic scenes, to see sequences in motion, to understand perspectives and events that are otherwise hard or impossible to observe in real life. The use of moving images and sound allows the user to compress or expand time by accelerating or slowing down the recording, to record and show unique, rare or unusual events, to show the detail by magnifying or the whole by miniaturising.

Pre-recorded video can be used at any time to retrieve the recorded information. Video is usable with large as well as small groups and for individual viewing. Video is easily applicable but as always there are some basic rules and guidelines that need to be followed if you want to use it most effectively.

Firstly, identify the reasons which make you want to choose video. From a cognitive point of view, video can be used to transfer information such as what happens in a certain process (e.g. how the combustion engine works, how crops develop over time). In the psychomotor domain, video can be used to show, teach and train certain skills (e.g. how to dismantle an engine, how to manipulate tools) or certain competencies (how to carry out an interview, how to lead a discussion). On the affective training level, video can be used to convey emotional messages or to help the trainee to empathise in certain situations. It can be used to show how people react to certain messages, for example it can help the medical doctor understand what a certain diagnosis can mean to the patient and his/her family.

Secondly, as with any other training product, the trainer should evaluate the applicability of a video for the training purpose. Does the programme suit the target group? Does it address all the important points that need to be made? Is the video still up to date? Is the quality of images and sound sufficient and compelling? Does the video use its specific capabilities to full effect in its combination of sound and images, is full use being made of all possibilities by the use of colour, graphics and animation, magnification and reduction?

Finally, the video should fit into the overall didactic concept. It is often said that video makes learners lazy because they only need to watch and listen. To become an effective instructional medium, video needs to be embedded in the instructional process. The trainer or course designer needs to ask him/herself a few key questions:

- At what moment during the course or class will the video be used?
- What activity or outcome is expected of the learners before, during or after the viewing session?
- What kind of information needs to be conveyed before or after the viewing session?
- Where do the trainees need to pay special attention?
- What points need discussion? What, if any, questions need to be asked afterwards e.g. to assess the training outcome?

Furthermore there are a few technical or organisational questions:

- How long is the video programme?
- What is the (playback) system: videotape, compact disc? And what standard will be used (VHS, PAL* or Secam*?)
- Is suitable playback equipment and viewing accommodation available or accessible for all learners?

Then the trainer needs to decide how to use the video programme: he/she can use the programme exactly as it is (i.e. adopt it) when it exactly meets the training purpose. When the trainer decides to match a certain programme closer to the target audience and to the training objectives, he/she can adapt the content by showing the video in a form other than its original form. For example, fragments can be omitted or repeated, the order of parts can be altered. Finally, a video programme can be used for purposes other than those originally foreseen. A video could have been made with a particular target audience and a particular set of objectives in mind but this may not prevent it from being used in a completely different context. A typical example of this change of objectives is the frequent use of news broadcast recordings in language learning.

To make effective use of video, the trainer or course designer needs to look at three key moments in the application: before, during and after the viewing session.

Before the viewing session, the trainer may need to give instructions to the trainees on what to pay special attention to, or raise the level of interest in the programme's subject matter, e.g. by way of asking targetted questions. It will also be necessary to check if the existing knowledge level of the trainees matches the content of the programme and if this knowledge needs refreshing. Maybe the teacher will need to introduce the programme and its objectives or perhaps the programme does this by itself.

During the video playback it is possible to stop and start. This can be useful when the video is too long to hold the attention span of the viewers. In that case it may be better indeed not to show the whole programme in one go (as is usually the way the video programme has been planned to be shown) but to interrupt the video with question-and-answer sessions, discussions, repetition or omission of certain parts, etc.

Finally after the viewing of the programme, certain activities may need to be planned: is it necessary to check whether the learners have learnt the right issues from the programme? In what way are you going to assess this: by questions, by discussion? What are the overall reactions of the learners to the programme and how do you think you can improve its use?

Recording video as a training tool

Video can also be used very effectively to record, evaluate and give feedback on the behaviour or on the work skills of the trainee. The Human Resources Management trainee, for example, can be recorded during real or staged interviews; the trainee-technician can be recorded carrying out a complicated repair. Recordings of certain actions can give the trainer an objective and precise rendition of these actions. By analysing the recordings together with the trainee, the trainer can help him or her to gain better insight into their strengths and weaknesses, into their abilities or into their presentation and behaviour. In addition to the verbal information, non-verbal behaviour and attitude can also be assessed. It must be said, however, that not all trainees react positively to a recording of their performance: this type of confrontational use of the medium may cause unwanted side-effects such as fear and uncertainty. Finally, the use of video as a recording tool in training has to take into account the privacy of the recorded subjects. Written approval beforehand, no public or third-party use of the recorded materials and no extended storage of the recorded materials beyond the period of training, these are the minimum rules to be applied.

Live video

When it is necessary to reach certain larger groups of trainees, or all employees at a given moment and at the same time, it may be worthwhile investigating the use of some kind of broadcasting technology such as television transmission. A few examples may help you understand better how video transmission can be useful for training.

EXAMPLE 1: Medical operations are carried out in specific locations that are not equipped to host large audiences. In order to give demonstrations to larger groups of specialists or students, it is common practice nowadays to bring a camera into the operation theatre together with a microphone and perform the operation/demonstration in front of the camera. The video images and the accompanying commentary from the surgeon are then transmitted to an auditorium where a large audience can follow the operation. By means of a return audio line from the auditorium to the operation theatre, members of the audience can ask questions directly to the surgeon and interact with him/her and the operating team. The distance between the operation theatre and the auditorium will dictate the kind of transmission technology used. Video and audio lines carrying the unaltered video and audio signal will carry the signals up to a maximum distance of a few hundred meters. For longer distances it may be necessary to transmit the signals via some form of videoconferencing technology (see chapter 3) over PSTN* or over the intra-institutional LAN*. Satellite TV transmission technology has also been used for this type of point-to-point (or unicast rather than broadcast) transmission. Key selection criteria for the transmission medium are:

- Quality of transmission required: in this example, the surgeons need to get the best possible picture quality. Therefore image compression* should be avoided or chosen very carefully.

- Format and style of the programme depend highly on your target audience: in the aforementioned example, users do not expect a formal TV broadcast style approach: fancy titling, dynamic camera movements, background music are avoided.
- Geographical spread of receive and transmit site(s): while it could be cost-effective to physically connect two sites with fixed cables in the case of two sites that are very close to each other, it may be necessary to use satellite transmission if there are for example more than a limited number of sites and when these sites are widely spread, e.g. over a whole continent, or even worldwide.
- Budget limitations may reduce for example the number of receive sites or your geographical reach, the transmission quality, the style and format of your programme.
- Availability of access to alternative networks will enable you to select from a broader range of transmission options: you and your receive sites may or may not have access to ISDN*, cable networks*, satellite transmission, etc.
- Privacy and security of the transmission technology: e.g. you are not going to broadcast a medical programme via a public cable TV network, unless you can assure appropriate encryption* or scrambling of the contents.

EXAMPLE 2: We take a second example from the automobile industry, where a large car manufacturer was faced with the challenge of providing an urgent retraining scheme for a certain model in a very short time period. This retraining scheme had to be made available to all the car technicians responsible for this model in all the local dealer shops worldwide. The target audience involved more than twenty thousand employees, the time schedule from conception until final delivery of the training programme was to be as short as possible but certainly less than three months. The training programme contained instructions on the complex fitting of a replacement car part. The content was suitable for video and therefore the training team decided to record the whole procedure analytically, add voice-over commentary in various languages and distribute this video programme worldwide. In order to enhance the training aspect and to enable direct feedback and questions from the trainees, it was decided that the video programme was to be broadcast live to all car dealers of this particular brand over the world (although in several language and time-zone-specific versions). All car dealers in the network were equipped with satellite receivers and tuned in to the live broadcasts via satellite. During the broadcast they could ask questions directly to the experts presenting the live programme via telephone, dialling a localised 0800 or other free number in their own country. The local dealers and their staff were encouraged to record the video programme at their site for future reference. This distribution of a just-in-time training course proved to be the only cost-effective and timely way to deliver the content in a pedagogically acceptable manner. The evaluation of this entire operation was very positive and since then the car manufacturer has made regular use of what has become a kind of 'worldwide corporate TV network'. This is not only used for global staff training but also for intra-corporate communications and global corporate team building, which can be considered a major positive side-effect of this type of interactive TV.

In a similar way, there are many cases of smaller companies who have leased television airtime from local, regional or national broadcasters to effectively transmit corporate programmes often consisting of company team-building and public-relations content as well as some basic training materials.

EXAMPLE 3: Stanford University in the USA is one of the most renowned and respected universities in the world. It offers not only courses to the on-campus students but also to off-campus students that are often employed in the Silicon Valley area around the university. Furthermore it offers courses on demand to many larger companies in the surroundings. Because it cannot physically accommodate all the different types and sizes of student population on campus, it has put in place a course delivery mechanism to serve all its target audiences, making use of various video transmission technologies. All auditoria where the lecturers are located are equipped with good-quality TV cameras and microphones as well as with peripherals to capture all the course materials the teachers are using (electronic whiteboard, computer graphics output, electronic writing tablets, slide and document scanners, etc.). The video and audio signals are then transmitted not only in video format over the campus TV cable distribution network to all the students' homes, but also to the regional cable TV network to which many off-campus students and companies are connected. For the more remote companies and students, access is offered through a high-bandwidth* telephone channel using a T1 telephone connection (T1 is the US 1.5 Mbps* equivalent of the European E1, a 2 Mbps telephone connection) which guarantees a near-VHS video quality transmission. On top of that the university offers the same lectures live via streaming video on the university web site, be it with much lower quality to accommodate dial-up connections* via 28.8 kbps modems* and higher. All this is retransmitted live and directly and students are given the opportunity to interact instantly via e-mail* or phone with the lecturer in the originating classroom. Furthermore, to enable students who are unable to follow the lectures directly because of time constraints, all lectures are recorded on videocassettes and stored in the university library for later retrieval. At the same time, the recordings are digitised, compressed and indexed by means of keywords and key concepts and stored on large-capacity digital* media storage servers*. Students have access to these servers via the Internet and retrieve the lectures according to their needs at the time and place that suit them best. Interaction with the lecturer is asynchronous* in this case and usually happens via e-mail. This is a typical application of video-on-demand*. [2]

[2] As described at an international conference on Online Learning in 1999. Book of Abstracts - Online Educa Berlin 1999.

Audio

In principle most of what we have described in relation to video can be applied to audio. In some cases it is neither necessary nor essential to have images accompanying the learning content. One obvious example is the use of audio recordings to improve pronunciation while learning languages. Distribution of audiocassettes or audio CDs with speech exercises may be sufficient for individual time-and-place-independent practice. In other cases telephone conversation, audioconferencing (multiple-party telephone conversations making use of an audio bridge*) or audio broadcast (via radio) will be complementary to other parts of a particular course that are produced in a different format (books or printed materials, slide shows, etc.). A typical example of audio-based or audio-supported training is the use of telephone-supported tutorials for PC maintenance and installation training, which is very comparable to telephone helpdesks.

Another more elaborate example is the application of audio graphics*. In its most primitive way audio graphics can be described as audioconferencing using telephones or speaker phones (and in addition to that, when more than two participants are involved, also telephone bridges) supplemented with graphic devices that send and receive text and still pictures. Historically such devices have

been separate pieces of equipment, but with the strong emergence of the personal computer and the Internet, audio graphics are now converging onto the desktop PC and have changed their name to groupware*. Groupware allows the remote sharing of software applications and computer files via some medium of communications technology in addition to a synchronous audio connection that allows spoken communication. This is usually done via the Internet but for more reliable and faster connections, ISDN is very often used. This technology comes close to videoconferencing: it enables the exchange of visual information (the on-screen display) and spoken content in a synchronous way.

Although audio graphics* (and groupware) as well as audio recordings can be a very cost-effective way of training many different course contents, it has so far not seen the success of other applications such as web-based training or videoconferencing. As with many audio-based training applications, the lack of appropriate visual support materials can be a disadvantage for many learners, especially with learners that are getting more and more used to visually stimulating and engrossing learning experiences.

Producing video on the desktop

Producing video by using editing techniques, music, voice-overs, titles and special effects, and publishing the final video to the web, CD-ROM*, e-mail or videotape, are easier than ever. It is true to say that the quality of video depends on the scenario, the content and many other issues such as lighting conditions, sound quality and performance of the actors appearing on screen. However, the greatest barrier to producing products that are of technically acceptable quality is being overcome by the increasing availability of software* and hardware* tools. These allow the end-user to edit and process video on her/his computer and to publish the video afterwards on the web, on CD-ROMs, or on traditional videotape.

Minimal investment should include a reliable camera, preferably recording in the digital DV format (cost starting at 2,000 EURO); additional investment could go into a tripod, auxiliary sound and lighting equipment, monitors, etc.

The final postproduction (editing) can be done on any powerful multimedia PC equipped with one of the following soft- and hardware packages:

Avid Cinema is by far the easiest software to use and the quickest way to edit a video. Avid Cinema only captures at 320 x 240, which is only 25% of the pixels on a normal TV screen, and therefore the playback quality on VHS tapes or CD-ROMs is limited. This software is perfect for general use by trainers and trainees who are not familiar with high-end production and editing techniques. (ost around 400 EURO).

Adobe Premiere is a much more powerful package and by consequence it is more difficult to learn how to use. This package will perform best when you have a good-quality video capture board installed that will capture 640 x 480 pixels and output at the same resolution*, a guarantee for better final video quality. Lots of additional plug-ins and filters can be added to enhance the video editing with effects, etc. (cost around 1,250 EURO).

Final Cut Pro from Apple is probably as powerful and easy to use as Adobe Premiere but it has the advantage of capturing digital video via Firewire (a high-speed link between a digital video camera such as the Sony TRV9 and the editing computer). Technically speaking, the final output quality when shooting the original footage with a digital

TECHNICAL IMPLICATIONS

As you have probably realised by now, this chapter covers a vast range of potential technologies. Depending on the objectives and the scope of the training application, you may need everything from a telephone or an audiocassette recorder to access to fully equipped television studios with satellite transmission technology. The use of any of these options will also affect as well as depend on the availability of receive and display equipment on the end-user side plus the typical nature and quality of the distribution channel itself.

You may already have available suitable communications systems for the simpler video and audio applications described. When moving onto more complex applications it soon becomes necessary to call in expert help unless there is a professional multimedia* and audiovisual support unit at your disposal. Production of multimedia materials, even common video and audio programmes, should be done with sufficient care from the beginning (a clear description of the expected result) to delivery and evaluation. Although multimedia PC manufacturers and software producers will encourage you to believe that it is now very simple to make great video programmes with affordable video cameras, affordable PCs and affordable editing software, the production of appealing, successful and cost-effective multimedia materials is not really a do-it-yourself job.

video camera is comparable to what one sees on regular TV broadcasts and looks as good as a DVD* movie. (cost around 1,250 EURO).
It should be noted however that the overall quality of the video always depends on the professional, technical and creative skills of the operator(s). When the objective of the video is to impress the viewer, or when the requirements of the recording are critical, it is strongly advised to subcontract the job to full-time video production professionals. The overall cost of the production will increase significantly (expect a cost from anywhere between 400 and 4,000 EURO per minute of final video depending on the style, quality and complexity of the job).
Professional video makers use a different language and terminology than the one we have used. They will refer to other recording standards such as Digital Betacam, MPEG-2* decoding, etc. This should not confuse you.
Make it very clear to the production team what your objectives are, what your final application for the video will be, i.e. output to a web site, CD-ROM or videotape, who your viewers are.
Rely on their expertise, their reputation and the examples of their work that are similar to the job you require from them.

Table 6:
desktop video production

10 typical stages of production

When you are involved in the production of any type of training programme, you should be very aware of your specific role and what the others involved expect from you. This means having a good understanding of the production process and your role within the production. You are the expert on your company's behalf on realising the objectives that have been set for the programme.

Prepare a brief asking yourself some key questions about (for example):

- Audience: who, how many, where, expectations, previous experience and knowledge, culture, language, age, etc.
- Objective: can you prepare a clear and concise description of what you want to achieve with this production?
- Content: is any of the content already available and/or suitable for use? Does it all need to be created, translated, and adapted?
- Timescale: when do you need the product to be ready? Does the production process itself impose certain time constraints (such as snow in July)?
- Budget: do you know how much it will cost and do you have the budget allocated? Do you have a contingency plan should you require a budget raise?
- Approval process: who will approve the product and at what intermediate stages? Will end-users be involved?
- Viewing and distribution conditions: have you got a clear view on how to get your final product to your target audience, wherever they may be? Does your target audience have at its disposal the necessary equipment to use your product as foreseen?
- Support of the programme and accompanying materials: does the product require accompanying print materials, or additional tutor support, etc. And if so, who is responsible and paying for this?
- Make a plan as to how approval will be sought within the company; involve others in this plan. Ensure that this approval plan fits in with your production timescale.
- Shortlist potential suppliers (in-house as well as external) for the different parts of the production process: scriptwriting, pre-production, recording and production, post-production, duplication, distribution.
- Compare the proposals and treatments from the suppliers on the basis of cost, quality, previous experience, added value, creativity, fitness of purpose and empathy to the project.
- Draw up the contracts.
- Check the script with everyone involved, content suppliers (trainers, tutors, experts, etc.) and scriptwriter(s), to make sure it meets everyone's expectations. Remember that changes can be made easily and cheaply to a script at this stage. These changes can affect the budget and the outcome of the production itself enormously.
- Give a brief for the people involved in the production: director, graphics designers, sound engineers, editors, experts and actors, etc.

- Take part in the recording: you are most valuable as the go-between that can assist the production team during the production e.g. on site recordings within your company, making arrangements with staff, etc. This will also allow you to participate in any decision-making during the production.
- Approve the rough cut (draft edited version).
- Approve the programme.

Cost implications

The first applications of distance learning with video and audio date back to a time when a number of large education providers as well as distance teaching institutions teamed up with television broadcasters (usually public service broadcasters), often at the request of the national or regional government. The system relied mainly on one-way delivery of educational materials to the learner; tutorial services were - if present at all - minimally supported. For the first time educational services began to include multimedia* specialists amongst their ranks (video and audio production staff, animation and graphics designers). Investment in the production of multimedia course content required a major additional investment from the course provider. The teaching and learning services such as local tutorials, assessment, examination and feedback caused only a marginal cost increase in the overall operation, because traditional educational providers were already providing them.

Nowadays, video-based solutions for in-company training (the materials produced in-house for internal use or commercially available products that can be made available off the shelf) follow the same business path, although usually at a lower cost than those made for television broadcast.

Producing an English course textbook may cost a few thousand EURO, a good English course with audiotapes twice this amount, but a complete TV series (Follow Me, BBC, London) or video-based course (Dutch for Foreigners, ILT-ACCO, Leuven) will cost some hundreds of thousand EURO and sometimes even million EURO. There are many examples of success-stories using video, such as the National Technological University (NTU), the University of Phoenix and Stanford University in the USA. In Europe successes include EuroTransMed (for medical training), the BBC/Open University (UK), RAIsat/NETTUNO (Italy) and EuroPACE (Belgium), who offer many programmes for continuous in-company or on-the-job training as well as customised or on-demand training programmes for use in companies, institutions and businesses.

One particular example of how you can radically reduce production costs is by recording ongoing classes (the 'candid classroom'). By putting a camera and microphone in front of a trainer, you can effectively reproduce the training classroom to a certain extent. However, not all the aspects of the training experience can be captured in such a way: the recording has to be done very skilfully in order to display supporting visual materials properly, interaction may get lost in this process, etc. In order to manage costs and keep the training outcome under control, it is important not to create tasks for the trainer that are remote from his/her regular training job and to keep the process as close as possible to that which happens in the traditional face-to-face training environment. The limited audio-visual quality of these classroom recordings (inferior compared to regular

mainstream television broadcasts) is compensated for by the relatively cheap and effective result of the training at home and at the workplace. These recordings can result in reducing travel costs for trainers and trainees, while the main pedagogical advantage lies in the fact that the same training becomes available to many more users within a short timescale.

Hardware* investment is relatively low on the end-user or learner side: a television set is usually all that is required (sometimes with additional video-recording equipment for playback of pre-recorded programmes). For live programmes access to the broadcast network is required: depending on the broadcast system used, the television set must be connected to a terrestrial antenna receiver, a cable television connection or a satellite receive unit (dish, receiver and in some cases a decoder). Although all this represents a reasonably low investment cost, for in-company training, the infrastructure requirements can be perceived as a barrier e.g. when many hundreds of remote sites are involved.

The economical savings of this approach come from the fact that costs in learner equipment may substitute for training facilities and training rooms (in cases where the trainee is allowed or obliged to follow the training course away from the company) and the consequent travelling costs. This rationale is not always applicable because many company-training centres encourage trainees to follow the courses during working hours at the company's premises. A successful business model may depend upon the trainees investing in the equipment themselves, studying at home and/or receiving some return or incentive from the company in return for learning in their own time.

A highly important cost consideration is the matching of the production cost to the potential uptake: in some cases courses may only have a very short life cycle where there is a small potential user base for the product. This is particularly true in sectors like information and telecommunications technology, biology and medicine. In that case, there is little advantage in raising the course profile by adding high production costs. Stable course contents may see a return over a long period (e.g. language courses) and therefore deserve a higher production profile and investment.

Case study

Certificate in Safety and Health at Work, Ireland [3]

[3] As described on the UCDublin AVC website: http://avc.ucd.ie/

This multi-disciplinary certificate course in Safety and Health at Work is intended for managers, supervisors, safety representatives and others with an interest in safety and health in the workplace. It is offered by the Centre for Safety and Health at Work, which is part of University College Dublin's (UCD) University Industry programme. The course is an introduction to a comprehensive range of topics relating to safety and health in the workplace including legislation, safety management, identification of physical, chemical, electrical, psychological and ergonomic hazards, risk assessment; control and monitoring. The course is a one-year, part-time study programme organised over twenty-five weeks. The course is transmitted live by satellite to centres throughout Ireland, on Friday mornings for twenty-five weeks. This is a direct-broadcast satellite-based method of education using television and telephones to teach at a distance, supported by tutorials and texts. Students go to the local centres to attend class, while the lecturers themselves are in UCD. The illustrated lectures are televised and distributed 'live' by satellite to the local learning sites. A discussion session follows, where students can directly telephone the lecturer in the studio with questions and get an immediate answer in

the programme. The lectures are based on the comprehensive learning materials supplied to the students and are supported by one-hour, small group tutorials with a local tutor. Full-text support is also provided. Lectures are given by leading experts in each topic, from various faculties within UCD and other universities, the Health and Safety Authority and public and private-sector industries. Students undertake two projects and a written examination. The examination takes place in May in approved, local centres. There are 7 participating centres spread throughout the Republic of Ireland offering local site facilities during 1999/2000. Courses are also offered in a number of in-company training centres. This model has proven very successful for a number of years with a high level of participation and satisfaction.

The Business Café Open University Business School, UK [4]

The Open University (OU) uses broadcast to deliver teaching materials to students through partnership agreements with the BBC. The BBC allocates specific time slots for OU programmes on BBC2 TV and Radio 4. Broadcasting has created a large non-student audience and greatly increased the OU's public image in the UK. The Open University Business School (OUBS) produces audio, video and CD-ROM* products for use in its own teaching distance programmes.

[4] As described at an international conference on Online Learning in 1999. Book of Abstracts - Online Educa Berlin 1999.

The Business Café project was the first major experiment within this process of development by the OUBS. The Business Café combined synchronous broadcasting on BBC public television with an advanced web site. The project is a way in which broadcasting can be integrated with new applications of telecommunications and informatics. The idea behind this is that television viewers are drawn to the web site and the web site adds value to their viewing by offering further knowledge and enabling discussion. The programme was targetted at managers and staff in small businesses as well as at the large OUBS distant community of Associate Lecturers, students, clients, partners and alumni.

The Business Café programmes were broadcast on a weekly basis in Spring 1999 from 7.45 to 8.15 on Sunday mornings. Participants in the Café discussions were management academics (many from OUBS), business professionals, journalists and experts. Each of the 9 programmes included a main feature (based on OUBS research expertise) and a series of regular weekly items. The feature was introduced through brief discussion in the Café and explored through filmed 'case study'-style reports. Regular short items included a 'taxi ride' with a business figure in the news and an 'office of my own', giving a tour and explanation of how organisations and individuals are using their office space. Each programme discussed a business book and finished with a stock market commentary.

The URL* for the web site was regularly shown on screen, together with invitations from the presenter to log on and take part. She also gave a brief report on camera about the contributions to the Business Café online* discussion forum during the previous week. The topics featured were: E-commerce, Intellectual Capital, Social Entrepreneurship, Innovation, Knowledge Management, Family Values (in business), Regeneration, Risk and the 21st Century Manager.

Up to 8% of the total audiences (terrestrial, cable and satellite) was reached (300,000 live viewers) for each of 9 weekly broadcasts. A further audience occurred later as the programme was video recorded (but no data available). The audience came from the target group - i.e. middle or senior managers or small-business owners. They represented almost every industrial sector and type of managerial job and were typically 35 - 54 years old.

Throughout the television broadcasts, the presenter referred to The Business Café web site. Each week the team created a fresh new site and discussions week on week for 9 consecutive weeks. Each new web site focussed on the features in each TV programme. The Business Café web site included:

- This week's feature streamed onto the site through video.
- Video streaming of the book review shown on the programme that week.
- Computer-mediated discussion area (using open access web version of First Class*).
- 'Business briefing' - downloadable* specially produced article for each feature.
- Special collections of relevant web sites to illustrate the main feature of the programme.
- 'Tell us about yourself' - an opportunity to collect feedback on viewers and visitors to the site.
- Links to the main OU and OUBS sites.
- Link to the OUBS brochure request.
- Link to main BBC site.
- Link to Amazon for book ordering.
- Link to the Microsoft MediaPlayer site for video player download.

Following the first week's television programme, there were 4,000 visitors to the Business Café web site. This rose to just around 6,000 per week throughout the 9 weeks, except for weeks 7 to 8 when it reached 8,000 per week. Around 42% of the visitors to the web site logged on during the day of the television broadcast in the morning, with the remainder during the following week. Around two thirds of the web visitors were prompted by the television programmes and the rest found the Business Café site through other sites on the web or by recommendation. Visitors logged in from all over the world (outside the television range), watched the video clips and contributed to the online discussion.

Advantages

Using pre-recorded video and audiotapes allows the trainer to fully control the contents that are to be delivered to the trainee. If well-designed as described earlier, such materials can go a long way towards realising the objectives of the planned training scheme in that such materials can be used to illustrate, motivate and even captivate the trainee. They can be used to show processes, activities and procedures that may not otherwise be available to the trainee and can be cost-effective and easy-to-use media when used in an appropriate overall training scheme which makes best use of economies of scale and existing technical facilities. Such materials are often multi-functional and can be used to introduce topics, to reinforce learning and to act as a handy resource when trainees wish to refresh their understanding or skill in a particular area. Such materials have another advantage in that not only are they multi-functional, but they can also be suitable for a variety of distribution systems and are very flexible in the way in which they are used. The same material that is created for a live satellite broadcast may also be used later by making it available on a video server so it can be accessed in a video-

on-demand environment. If using standard formats like VHS, the supporting infrastructure on which to record and play such materials is now commonplace.

Live broadcast of images and sound can have additional advantages in that trainees will often feel very involved in such broadcasts, the 'live' aspect adding a certain excitement and urgency to the training. By combining such broadcasts with real-time interaction via telephone for example, the trainee has the added bonus of being able to access up-to-date and accurate information to meet his/her specific needs.

Disadvantages

The production of audio and/or video for training purposes can be a costly and frustrating business if the training manager is not fully prepared and clear about his/her expectations. There are many examples throughout the training industry where pre-recorded materials that have been commissioned fail to meet their objectives largely as a result of poor communications between the commissioning editor (in the training department) and the producer of the materials (located either in or out of house). Making your own materials using the vast array of increasingly available digital* tools can also be disappointing if those using them have not sufficiently investigated what the system chosen can and cannot deliver in terms of quality. They also require the acquisition of a number of additional skills, which can be a costly process in itself.

Pre-recorded or live video and audio have another disadvantage in that of themselves they do not have a built-in interaction path for trainees to use if they have questions or wish to engage in a discussion about the training content. Therefore training managers who wish to include some form of interaction, synchronous or asynchronous*, need to consider how this will be achieved and put a system in place to support it.

Finding a suitable distribution channel can be quite a complex challenge and will probably require the input of experts when considering channels such as satellite or web-casting. Again, having a very clear idea of who exactly you wish to reach, in what time frame and the level of technical support and resources at each site will go a long way towards avoiding costly mistakes.

It is essential for you to stay focussed on the content and not to fall in love with the style or design of your programme: when you are not familiar with the use and effectiveness of video and audio in a training context, too often style takes over from content and the product remains unused in the training department despite having made a great impression on the management.

KEY DECISION-MAKING ISSUES CHECKLIST

Now take the time to read through the following checklist, to find out if training using video or audio is right for your organisation. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues.

- Is your use of video and audio sufficiently embedded in the overall training scheme to ensure full learner support and overall success?
- If choosing to use pre-recorded video or audiotapes, are you sufficiently sure they exactly suit your purpose: audience, objective, content, timescale, budget, viewing and distribution conditions?
- If they don't suit your training scheme exactly, have you taken steps to make suitable adaptations or to support the training with other materials or resources that better suit your purpose?
- If choosing to copy or adapt pre-recorded materials, have you received permission to do this from the producers of the materials?
- If you are planning to use recordings of trainees engaged in certain aspects of the training activities, have you fully explored the implications of this and received all necessary permissions?
- Have you decided what your distribution channel will be and taken the necessary steps to ensure this channel will function to the satisfaction of all concerned?
- Have you carried out a full cost-benefit analysis of all the distribution options available as part of your decision-making activities?
- If choosing in favour of a one-way distribution channel, have you considered how communication from the trainees will be facilitated (helpdesk, e-mail question and answer service, discussion forums, etc.)?
- If choosing live broadcast, have you planned and budgeted accordingly?
- If deciding on live broadcast, are you sure that all your target receivers have sufficient resources to receive the materials and are they fully aware of the implications of such broadcasts?
- Have you fully considered when the training is to take place: as part of the trainee's normal working day; during time spent away from his/her workplace but still in working hours; or in his/her own time?

Chapter 2

CDs, DVDs and hybrids

Introduction

Compact Discs (CDs) and Digital Versatile Discs (DVDs*) have largely become the bearer of what was previously known as CBT - Computer-Based Training. They provide a way in which a large amount of multimedia* training material can be made available to employees on their local computer either at the workplace, in a dedicated training centre or for home study. They are essentially a stand-alone training option that allows self-paced learning. Although we shall be dealing with them in this chapter as a separate training option for the HRM manager, they are usually used as part of an integrated learning approach. This is likely to be a hybrid solution combining such products with online information sources - especially web sites. Other typical hybrids are those that mix such products with some form of communication medium between tutor and learner to allow the learner to ask questions or discuss the contents with a support person. They are also often used in collaboration with face-to-face training where a learner is expected to go through such a piece of software* before a face-to-face training opportunity in order to become familiar with certain aspects of the training.

Generic description

Digital* optical storage systems such as CD, CD-ROM*, and DVD are based upon laser technologies for reading and writing data. Optical storage devices offer high data storage capacities (e.g. CD-ROM can store 640 MB of data, while DVD can potentially store up to 17 GB).

Data is digitally stored on an optical medium as strings of 1's and 0's, in the form of tiny holes on a reflective surface. For example, music stored on a CD is represented by a string of 1's and 0's; when these strings of binary data are replayed at 44,000 times per second, they generate a correct rendition of the music.

Optical storage products include the compact disc range of devices (CD, CD-I, CD-ROM, CD-Video, CD-R*), the Digital Versatile Disc (DVD) family of technologies (DVD, DVD-Video*, DVD-R*, DVD-RAM*) and the various magneto-optical devices (which combine magnetic storage and optical storage techniques). For this chapter, we will only consider the first two (compact disc and digital versatile disc), as they are the most popular formats.

Compact Discs (CDs)

CD-ROM

The CD-ROM or Compact Disc-Read-Only Memory is a type of optical disc capable of storing large amounts of data; most commonly 640 MB (megabytes*) although up to 1 GB (gigabyte) is also possible. To compare: a CD-ROM has enough capacity to store more than 250,000 text pages, 600 times more than a floppy disc. CD-ROMs are stamped by the vendor or by the producer, and once stamped, they cannot be erased and filled with new data, unlike with floppy discs. To read a CD, you need a CD-ROM player, i.e. a CD player, most Playstations, a CD-ROM drive in a multimedia PC, etc. The platform converts the digital signal into audio, video, data and text information. All CD-ROMs conform to a standard size and format, so you can load any type of CD-ROM into any CD-ROM player. In addition, CD-ROM players are capable of playing audio CDs, which share the same technology. CD-ROMs are particularly well suited to information that requires large storage capacity; therefore CD-ROM is primarily used as a mass storage and information delivery medium. This

includes software applications, graphics, sound, and especially video. CD-ROM is widely used for software distribution, and for multimedia interactive applications.

CD-ROM related products fall into two categories, information archives and CD-ROM publications. Information archives use CD-ROM mainly as a storage medium (a typical application would include software distribution) or as a method of backing up computer files or installations. CD-ROM provides a flexible, low-cost, mass-storage medium which can be used to deliver large quantities of media-rich information in a convenient manner e.g. video footage, large images, audio samples, etc. Published CD-ROMs include reference products e.g. multimedia encyclopaedias, consumer entertainment such as video games, and commercial information sources such as catalogues, regulations, user guides.

Technologically, the CD-ROM as a data storage format is obsolete, sooner or later to be replaced by a new standard, Digital Versatile Disc. Fortunately the installed base of CD-ROM readers will ensure that the standard will continue to be employed for the foreseeable future. The biggest business disadvantage of CD-ROM-related technologies remains that since the launch of the CD-ROM format some ten years ago, few publishers have succeeded in establishing a successful business model for CD-ROM publishing (outside of interactive computer games) and so far the commercial success of CD-ROM has been elusive. However, the format has been adopted by thousands of publishers worldwide as a convenient means of distributing information and multimedia content.

Hybrids

In recent years CD-ROM-based products have been increasingly linked with online* information sources - especially web sites. Each medium is generally used for what it is typically best suited to. The CD-ROM provides mass localised storage and high access speeds, which can be used to deliver information with rich multimedia content. Web-based information delivery, even with data compression*, cannot as yet compete with CD-ROM's capacity for delivery of audio and video content. CD-ROM mastering is expensive; it is not cost-effective to re-master a CD-ROM frequently. This means CD-ROM-based data can rapidly become out of date. By adopting a hybrid approach, combining the bulk of fixed information on CD-ROM with updates of the volatile information on the web, the best of both worlds can be achieved, providing the user with seamless access to media-rich up-to-date information. In hybrid products the CD-ROM application or the web page decide where to access data from which source, e.g. CD-ROM for audio-video information or a web site for up-to-date information. The application of hybrid CD-ROM and web technologies can include: updating and complementing the information on the CD-ROM via an online service; using the data capacity of the CD-ROM to enhance the graphics of an online service, e.g. storage of video or audio locally. It could also mean using the online service to provide interactive capabilities e.g. CD-ROM catalogues that have online purchasing capabilities. A typical and well-known example of the hybrid CD-ROM and web application is the Microsoft Encarta Encyclopaedia: while fixed information is stored on the CD-ROM together with multimedia materials, links from within the CD-ROM towards a specially created web site provide the user with updated and new information.

CD-R

CD-R or Compact Disc - Recordable is a form of CD-ROM that allows digital data to be written directly onto a CD from a personal computer. CD-R discs can store up to

640 MB of data and can be written to using a device called a CD writer, from a standard PC. Once recorded this data cannot be changed again. Most CD-R devices are classed as multi-session devices, which means they can write information to different sections of a compact disc on different occasions (called write sessions). Standard CD-ROM player devices can read CD-R discs.

CD-R provides a method of storing large amounts of information on a reliable and robust medium at relatively low costs (CD-R writers are available for less than 250 EURO, and blank CD-R discs cost as little as 2 EURO each). It is cheap enough to use on a daily basis for archiving and data storage and transport. Again, CD-R will be technically superseded by DVD-R (the recordable version of digital versatile disc) within the foreseeable future. DVD-R provides a larger storage capacity, starting at 2.66 gigabytes (4 times as much as CD-ROM). However, given the current extensive availability of CD-ROM readers, it is clear that CD-ROM will be around for quite some time.

One of the problems with CD-R discs is that you can only write to them once. With CD-RW drives and discs (CD-RW disc or CD-ReWritable disc is a type of CD disc that enables you to write onto it in multiple sessions), you can treat the optical disc just like a floppy or hard disc, writing data onto it multiple times. The first CD-RW drives became available in mid-1997. They can read CD-ROMs and can write onto today's CD-R discs, but they cannot write on normal CD-ROMs. At least for the time being, discs created with a CD-RW drive can only be read by a CD-RW drive. CD-RW discs will probably remain a popular storage medium until DVD devices become more widely available.

CD-I

Compact Disc - Interactive (or CD-I) is a proprietary CD-ROM technology developed by Philips in 1992 and originally aimed at the home entertainment market. CD-I has subsequently become widely used in Computer-Based Training (CBT). Philips introduced CD-I in an attempt to establish a CD-ROM format for the home that would provide a certain amount of interactivity with computer-generated and video-based imagery. Visuals and audio from the disc were displayed on a standard television, using a CD-I player. Control of the player was through a remote control or a tracker ball device. The limited availability of rather poor quality software hindered its widespread adoption as a home entertainment medium. As a computer-based training tool CD-I was however rather widely used. While CD-I development was expensive (as is any other interactive multimedia production), the CD-I player was relatively cheap (in the beginning circa 2,000 EURO, nowadays less than 500 EURO) and at the time economically more viable than early multimedia PCs. CD-I has generally been superseded by PC-based CD-ROM products. Adoption of DVD technologies is likely to kill off the long-term prospects of CD-I.

Digital Versatile Discs (DVDs)

DVD or Digital Versatile Disc is a new type of CD-ROM that holds a minimum data capacity of 2.66 GB (gigabytes), enough for a full-length movie. It is expected that DVD discs will eventually replace CD-ROMs, as well as VHS videocassettes and the large format analogue* videodiscs*. The DVD specification supports discs with capacities from 5.2 GB to 17 GB and access rates of 600 kbps* to 1.3 Mbps.
One of the best features of DVD drives is that they are backwards compatible with CD-ROMs. This means that DVD players can play old CD-ROMs, CD-I discs, and video CDs, as well as new DVD-ROMs. Newer DVD players, called second-

generation or DVD-2 drives, can also read CD-R and CD-RW discs. DVD uses MPEG-2 to compress video data.

MPEG	
The Moving Pictures Experts' Group (MPEG) is a working group of the International Standards Organisation (ISO), concerned with the definition of standards for data compression* of digital motion pictures, and associated soundtracks. This group from time to	time issues standards, such as MPEG-1, MPEG-2, which may be utilised by software* and hardware* system designers to develop products for the marketplace. MPEG-2 defines a bit* stream for compressed video* and audio optimised to fit into a bandwidth* range from 3 to 10 Mbps.

Table 7: MPEG

The DVD product range includes: DVD-Video, DVD-ROM, DVD-R and DVD-RAM.

DVD-Video is the designated name for the DVD format that will be used to store feature length film. A DVD-Video player will need to be used in conjunction with a standard television set, in order to view DVD-Video productions.

DVD-ROM has been designed to support computer-mediated applications and is expected to replace CD-ROM as a low-cost mass-storage medium. DVD-ROM player devices will be able to read existing CD-ROM standard formats.

DVD-Recordable (DVD-R) is machine-recordable and is expected to provide a large-capacity replacement for CD-R.

DVD-RAM is machine-read/writeable that means that it can be used in a similar manner to conventional hard discs.

Digital Versatile Disc provides access to massive storage capacity using a low-cost, easily distributed medium ideal for software distribution, data back-up, and new multimedia applications that are dependent on large amounts of information. DVD-Video provides access to feature-length digital recordings for consumer entertainment markets. DVD-RAM is anticipated to dominate the secondary storage market (mass storage and back-up), currently dominated by magnetic tape devices.

Potential hindrances to the uptake of the DVD are the lack of compatibility with current CD technology (CD and CD-ROM players do not play DVDs), the initial cost of the new equipment, the lack of support for the new standard from the publishers and the consequent lack of content in consumer or business markets.

CDs AND DVDs AS TRAINING APPLICATIONS

One of the first options faced with regard to the use of these products as training applications is whether they should be produced in-house or bought off the shelf. Like other products discussed in this handbook including pre-recorded video and audiotapes, this decision will be based on a number of factors including whether or not the company has sufficient resources available to produce products which meet one's overall objectives. Producing training materials using Compact Discs and DVDs is a job that combines technical, instructional, production and creative skills. First of all, training packages using Compact Discs or DVDs need to be pedagogically effective. This means the learner or trainee must be enabled through the product to reach his/her learning objectives and the trainer or course provider

needs to be able to help the trainee build up the skills and knowledge that are expected within the training programme. Secondly, the package needs to be interesting, motivating and appealing. Thirdly, the product needs to be flexible and adaptable. And lastly, when producing in-house, the production of the training package should not be overly expensive.

Pedagogical implications

Training institutions and training software production companies have invested a great deal of time and resources in creating authoring packages*. These allow authors, producers and editors of training software packages to create pedagogically sound products without too much effort (two of the best known products are ToolBook II Instructor and Macromedia Authorware.) Therefore many of the products available off the shelf meet quite high pedagogical standards. Elements of good instructional design such as student evaluation, tests and student follow-up or tracking are usually included in the software packages commercially available. These elements allow for a partial replacement of the traditional role of the teacher or trainer. Adaptation of the learning path to the student profile and objectives is also looked after in certain multimedia training packages (e.g. by the implementation of the Lotus Pathware learner management system or any other system compliant to the AICC* - Aviation Industry CBT Committee standard). However the most successful multimedia packages are still those that work in close combination with the presence (or remote support) of the trainer or tutor and which are produced by the organisation to meet their own specific training needs.

Very often the CD format is used to distribute learning packages that include a certain amount of simulation where the trainee can become familiar with and practise new techniques, processes and methodologies in a closed, controlled and safe environment. This practise and familiarisation can happen time and place independently and therefore is most suited for self-study applications. Also the fact that the learning path is highly controllable at the design as well as at the utilisation stage can be of great advantage to the training provider.

Technical implications

Using Compact Discs and DVD-based training products makes the use of (digital) telecommunications networks less essential. These products are therefore most useful - content permitting - when telecommunications networks are not available or too costly and the training organisation wishes trainees to learn on a self-study basis.

However, there are some requirements to be taken into account. These products obviously require a platform (player) on which to display their contents and cannot, like books, operate alone in the training environment. Although practically all companies nowadays have multimedia PCs installed at employees' workplaces, this hardware requirement should not just be overlooked. All trainees that need access to multimedia-based CD-ROM or DVD products also need access to the required hardware meeting the specifications of the courseware (graphic screens, special audio boards, special MPEG cards, DVD or CD reader, etc.). In the case of CD-ROM-based multimedia training packages, the video playback specifications (or read capacity) of the CD-ROM player may limit the use of the package if it does not have sufficient memory or capacity.

Cost implications

Multimedia productions on Compact Disc or DVD require investment ranging from 10 to 100 times the investment required for printed materials and are comparable to the production of high-quality video materials. This is mainly because highly specialised and creative staff are involved during the production process: graphics designers, videorecordist, photographers, copywriters, software developers, instructional designers are not all involved in plain textbook production. Cost issues such as Intellectual Property Rights (IPR*) are considerable when dealing with electronic media just as much as with video and audio production.

The initial level of investment is high for all products regardless of the potential size of the target audience. A microelectronics course may cost 10,000 EURO with a potential market of 1,000 users; a Business English course may cost 100,000 EURO, but with a potential market of 100,000. A clear shift towards consumer market and software distribution mechanisms can be observed in both uptake (customer profile and sales) and in production value (volume of investment). In fact software providers like Microsoft compete in this area with publishers and education and training providers (in-company training centres and universities). The latter often show very advanced prototypes, however, they are not always able to fully develop a multimedia publishing business.

It is usually only large companies who can publish multimedia training titles for internal purposes, commissioning the production of their highly specialised or customised training materials to outside companies. The need for multilinguality in larger European companies has also not contributed to a large uptake of disc-based training materials except for language learning materials where the volume of the market, the stability of the content and the low dependency on the language of the user play a role. In the USA on the other hand, the much larger monolingual user base has allowed for the production of a larger variety of multimedia titles.

Case study

KBC Bank, Belgium [5]

KBC Bank in Belgium is a new national bank formed as a result of a merger between 2 large banking entities. It is a typical banking company with a large number of branches distributed throughout the country and a number of centralised headquarters taking care of the various functions of the bank. There are about 6,000 people working in the headquarters and 8,000 people working in the branches. All employees require a certain amount of ongoing training accordingly as the bank develops its services and offers more products to its customers. Such training has traditionally been given by the bank's 3 training centres and has required members of staff spending time attending training sessions and then acting as resource persons in the further training of their colleagues. However the bank is increasingly turning to ICT* to support its training effort particularly as the pace of change picks up and the volume of training required increases in parallel.

[5] From an interview with J. Briers, training consultant KBC Bank, Belgium.

While investigating the possibilities of learning environments supported by various communication media linking trainees and trainers, the bank has already implemented a certain number of training initiatives supported by Compact Discs in a hybrid training scenario. The rationale behind this approach lay in the fact that the bank needed employees to attend traditional training courses already armed with a certain amount of information about the product or system that was the focus of the training course. When the bank recently changed its communications

network to a company-wide system linking all employees PCs, the amount of training required was very high. All employees had to become familiar with the new system in a very short time period, therefore the amount of training time per employee had, of necessity, to be quite short. Employees about to attend the training course, were therefore supplied with a CD-ROM which provided some background information on the new system and hints and tips on how the system could best be used. In addition to that, a number of simulations, showing how the various new applications could be used in sample situations, were distributed via the electronic bank network. Employees then attended the face-to-face training sessions in which the systems were fully explained and they had a chance to ask questions and discuss their use in the workplace. After the face-to-face training sessions, the role of the CD-ROM became one whereby it provided a handy reference for the employee who needed to check something or be reminded of certain aspects of the system. This hybrid solution combined synchronous with asynchronous* training, face-to-face with stand-alone, and is a typical example of the way in which companies are increasingly turning to ICT to support their training activities.

RHODIA Belle-Etoile, France [6]

[6] Case studies carried out in the framework of the transnational TIDE project (Information Technologies, Training and Employability) supported by the European Social Fund (ESF) in the Adapt-Bis programme.

RHODIA Belle-Etoile is a chemical factory, part of the RHODIA Group in France, and produces nylon. Over the last few years the management has been successful in increasing production efficiency. However this has had a number of important consequences:

- Production processes and methods have become more abstract for the operator; the contact with the materials and the production process itself happens often only through computer displays.
- The continuous production process has reduced the recurrence of problematic events.
- Older employees have difficulties grasping abstract production situations as well as events that rarely reoccur. It is necessary to visualise the production process for them.
- New employees need to supplement their theoretical background with knowledge that is based on or represents real situations and events from the production process.

As a conclusion, one could say that employees, experienced as well as new, have some difficulties sometimes in dealing with unforeseen, accidental or infrequently occurring situations within the production process. This of course is unacceptable within a factory that deals with corrosive and toxic agents.

To respond to this situation, it was decided to create a multimedia training package consisting of CD-ROM and print-based manual-type materials, representing and creating rare situations in a random fashion. The objective of the materials is to simulate problem situations in order to train employees to react in an appropriate way to the unforeseen situation. This approach should also allow the transfer of the available knowledge built up in the factory (from the older and more experienced employees) to be transferred easily to new and inexperienced staff.

To reach these objectives a feasibility study was carried out. In this study the employees (future users) as well as methodological experts were involved. One of the basic principles was to use off-the-shelf software that is easy to use. As a result

of the study, a pilot committee was formed integrating all parties concerned: the employees working directly in production, their managers, and the trainers as well as instructional specialists.

The main objectives of the project were clearly described:

- To enable employees to react efficiently to all kinds of events within the production process,
- To create a 'study case generator' that is easy to operate and maintain and that allows for a group work approach of the training at the same time,
- To allow for a diversified training approach to suit both young and inexperienced employees who have just entered the factory and older employees who may need some supplementary training or retraining.

The outcome is a CD-ROM with supplementary documents, a type of training manual. The contents include an introduction to the production installations and then a section about the installations as well as how to operate them. All possible events in the course of the production process are analysed, a decision tree is constructed per process and event, and correct diagnostics and reactions as well as inadequate actions and their consequences are researched and documented. The media to support all this information (pictures, sound, animations, etc.) are then collected.

The 'study case generator' is then built on the basis of all these materials: it consists mainly of a decision tree structure with causes and effects, displays of situations, decision path recording and adapted advice. The 'study case generator' is then finally added onto the other training materials. The pilot committee validates the training tool at every stage of its creation.

Commonly-known commercially available software was used to build this training tool: ordinary office tools such as text processing and presentation software as well as document storage and distribution tools. Audio, video and image processing software was used to create the multimedia archives and the audio-visual supported interface of the training. Exercises that enable individual assessment of the trainees were designed with an authoring tool. The training package caters for different types of trainees by incorporation of repetition, personalisation (each trainee can learn at his/her own pace, following a personal selection of course topics) and rapid progression towards assessment and consolidation of the acquired knowledge. The use of multimedia facilitates the learning.

The resources for the creation of the training materials are estimated to be approximately 274,500 EURO. This includes all software and labour. Labour is estimated at around 130 person days. The packages were developed in the course of 1998 and 1999.

Advantages

There is no doubt that if you are facing a large-scale training challenge that requires your trainees to have access to multimedia training materials, the use of Compact Discs or DVDs has a number of advantages. They permit the design of a clear learning experience involving reactions, simulations and interactions with the content. You can control exactly the message and content that they receive. Trainees can proceed at their own pace, time and place. You can build in systems and checks to ensure that they are able to evaluate their progress as they

go along through the use of built-in exercises, questions, simulations, etc. Because of the fact that such products can handle a rich multimedia format the scenarios and materials that you create with the training content can be produced to a high quality. They can also be used to replicate situations that otherwise might be difficult to replicate. This is especially true if you choose to use DVDs that allow for the highest quality of video, audio and animation. Given a scenario where trainees are well motivated, these products can provide a rich and powerful learning tool. In the situation where you produce your own Compact Discs or DVDs, you can produce them to exactly meet your training requirements, with only the information and skills upon which you are focussed and tailor-made to meet your company's needs.

CDs and DVDs are an inexpensive carrier for information of all sorts and can be easily and cheaply replicated and distributed because of their high data density, small weight and dimensions. This enables the production of even smaller numbers of copies, unlike with traditional print materials where the economy of scale dictates large numbers of copies before being cost-effective.

Cost of production can vary widely depending on the format and style of the final product. When used as replication media, CDs and DVDs are very cheap (mass duplication of video, audio, data). When DVDs and CDs are developed as a training product, cost issues are similar to those already mentioned. This includes the production of audio and video plus the costs associated with the typical design of non-linear programmes (involving interaction and reaction, customisable or personal learning-path design).

Buying ready-made CD-ROM and DVD titles may be an alternative when in-house production or customised production is too expensive or technically not feasible. The market for disc-based training products outside the field of computing and informatics is however not yet very extensive and may require further research on your behalf.

Disadvantages

Many companies report that one of the main challenges they face in the use of Compact Discs or DVDs for training purposes lies in relation to the motivation of their trainees. Unless trainees have a clear reason or need to use them they may remain unused. This is why most companies in our experience use such products in a hybrid training environment, backing up their use with face-to-face training sessions and/or helpdesk support from the trainer.

Also the ability to produce effective, motivating and appealing training packages that use the full advantage of disc-based systems, including good quality audio, video and animations, simulations and interactivity plus efficient instructional design is not yet widely available except in very large companies.

Buying commercially available products can also have certain disadvantages as companies discover that they are not exactly what the training organisation needs or wants. Many companies opt for using parts of one commercially available product with elements that they create themselves to deal with company-specific aspects of the training required.

KEY DECISION-MAKING ISSUES CHECKLIST

Now take the time to read through the following checklist to find out if training using Compact Discs and/or DVDs is right for your organisation. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues.

- Do you face a training situation that requires your trainees to have access to multimedia-rich training resources?
- Does the training content and method allow in the greatest part for self-paced learning and is tutor feedback or direct support not a main or essential part of the course?
- Do you know exactly what technical platform the product you are considering requires and have you sufficient technical resources?
- When choosing a format, are you sure it gives you the functionality you require?
- If you are choosing for a new format, are you choosing one that is backwards-compliant and which can handle any materials you already have and wish to reuse?
- Can the format chosen meet your distribution needs, i.e. can it be distributed within budget in the required format?
- If considering the purchase of commercially available Compact Discs or DVDs, are the rights and rules relating to its use not in conflict with your company's applications?
- When considering commercially available products, check carefully the contents for pedagogical approach in order to ensure that it is consistent with your company training policy.
- When considering a hybrid mix of commercially available products, coupled with your own especially commissioned products, have you checked whether they will fully complement one another?
- When considering creating your own Compact Disc and/or DVD products in company, are you sure that you can access the skills, the time resources and the budget to carry out the full production cycle including piloting and testing?
- When using CDs and/or DVDs for simulation purposes, have you checked that the simulations are sufficiently representative of the real-life situation being faced by trainees to make them useful?

Chapter 3

Video-conferencing

Introduction

Videoconferencing* is one of the most traditional forms of technology-based distance education and training. It allows you to see and hear other people while being located in different places. It can be a remarkably powerful tool for training. Of any of the applications discussed in this handbook, videoconferencing is probably the closest experience you can have to sitting in a normal classroom face-to-face with the trainer, teacher and other participants in the training session.

Adaptation of traditional classroom-based training to videoconferencing-based training (discussions, seminars, show and tell, demonstrations, etc.) is not the most demanding transition for the trainer or course provider. Taking into account common audio-visual guidelines and with a basic training in videoconferencing skills, most training courses and materials can be adapted successfully in a short time.

However there are limitations to the use of videoconferencing for in-company training, just as there are limits to what can be trained in the traditional classroom. While videoconferencing may be very effective for discussion or lecture-based training, it may not be as supportive of skills training or individual learning. As it is a synchronous medium (trainers and trainees have to be present at the same time albeit in different places) videoconferencing does not allow place- and time-independent learning and as with many other applications described in this handbook, is best used in a hybrid training programme combining the strengths of different solutions.

Generic description

A videoconference is an 'electronic meeting'. People in geographically different locations can see and hear one another, present documents and take part in a meeting as if they were all in the same location. For that reason, videoconferencing is often described as telepresence (connected although located in different place) and synchronous* (taking place at the same time).

Videoconferencing originates from the 1980s when businesses in the USA started to communicate with their remote branches in Europe via two-way satellite TV: participants in both places gathered in front of a camera and microphone and discussed business via (expensive) satellite TV communication links with each other. A number of years ago people believed that videoconferencing was soon to replace business trips and face-to-face meetings. The cost and complexity of the satellite TV technology however meant that large-scale take-up proved impossible at that point.

While videoconferencing can nowadays take place over any one of a number of different networks, in this chapter we will discuss how it is most frequently used in the training environment at the present time. The Integrated Services Digital Network (ISDN*) is a relatively fast digital phone line and is the most common standard for videoconferencing used today. ISDN provides telephone-based end-to-end digital connectivity, and a framework for the deployment of a new generation of integrated services for voice, fax, video and data communications. ISDN guarantees Quality of Service (QoS*) and a bandwidth* that allows an adequate level of communication of text, data, speech and video. In certain business environments, it is also possible to use videoconferencing over the company LAN*. However, videoconferencing connectivity is in that case limited to the clients with full access to this LAN. Although there are many experiences of using videoconferencing over the Internet, it is the opinion of the authors that this is not

yet mature to support learning in any meaningful way. This is due to the lack of any guaranteed Quality of Service and consequently the poor or unpredictable quality of the connection and/or the communication. In the future it is to be expected that when broadband* and reserved bandwidth becomes commonly available on the Internet, video-based applications such as videoconferencing will increasingly utilise the Internet as the connecting network. The functionality and methodology of videoconferencing however will most probably stay more or less the same.

Videoconferencing is conducting a conference between two or more participants at different sites by using telecommunications networks to transmit audio and video data both ways. For example, a point-to-point (two-party) videoconferencing system works much like a video telephone. Each participant has one or more video camera(s), picture display(s), microphone(s), and speaker(s) mounted on his or her communications terminal or a multimedia* computer that can facilitate videoconferencing. As the two participants speak to one another, their voices are carried over the network to one another, and whatever images appear in front of the video camera appear on the other participant's monitor.

Desktop video-conferencing system

Multi-point videoconferencing allows participants in three or more sites to sit in a virtual conference room and communicate as if they were sitting right next to one another.

Until the mid-90s, hardware* costs made videoconferencing prohibitively expensive for most organisations, but that situation is changing rapidly. Up until 1995 videoconferencing made use of dedicated terminals, videoconferencing codecs*, that were expensive, bulky and rather difficult to operate. Since 1996 when videoconferencing manufacturers began to integrate videoconferencing capabilities into the desktop PC, videoconferencing has become one of the fastest-growing segments of the ICT* industry. Over the last two years this increase has slowed down due to the explosive growth of pure Internet-based applications that do not necessarily require synchronous communication between the different participants in the communication process.

Videoconferences with larger audiences, require the use of a specifically-equipped room at each location, with video camera, document presentation and communication facilities. The telecommunication connection is usually made over ISDN or higher-bandwidth network connections (such as dedicated leased-line facilities).

For a person-to-person type of videoconferencing, Internet-based video telephony may be sufficient. This uses simplified video camera technology, and increasingly complex presentation products such as application or document-sharing technologies to provide a low-cost alternative to specifically-equipped rooms, especially when the need for visual contact between the participants is not absolutely required. Therefore IP-based videoconferencing will be acceptable if people already know each other well, and/or do not consider the image to be of central importance to the communication process.

VIDEOCONFERENCING AS A TRAINING APPLICATION

In the previous chapter we already explained the potential of audio-visual technologies to support training. Various factors and motivations influence the decision to use videoconferencing, which can be described as an application of audio-visual support technologies on classroom training to overcome distance problems. These factors reflect economic, pedagogical, organisational and social variables:

- Videoconferencing can greatly reduce travel costs and travel stress.
- It can improve the quality and the quantity (number of participants per contact) of the communication and as a consequence reduce the cost of hour/participant per meeting. Therefore, the number of meetings/training sessions can be increased and the contact between trainer and trainee improved.
- Videoconferencing can help overcome problems caused by geographical isolation and allows you to reach trainees in remote regions or in regions where you do not have a training presence yet.
- Videoconferencing can in addition reduce decision-making time in teams and allow for emergency training sessions.
- Videoconferencing allows the training manager or trainer to react instantly to unforeseen problems; for example if it appears that trainees do not understand a task or a piece of given information, he/she can immediately change or adapt the content or approach.
- Regular videoconferencing-based training sessions allow for a quicker distribution of the training content. Therefore time can be saved when immediate training outcomes are expected. These results can then be assessed at the moment of the training itself: the effect of being at different places at the same time (telepresence) enables instant feedback and continuous correction of the learning and training process.
- Centrally-organised videoconferencing sessions can decrease the communication costs of clients or at least allow strict control of the costs because the headquarters/training centre can establish the connections.
- Videoconferences also allow the training department to establish links outside the company. Guided tours, interviews with external experts, virtual meetings with company clients and suppliers, with other companies or training providers,

become possible when all parties have a videoconferencing terminal at their disposal.

- Videoconferencing has a strong effect on the building of a learner group, peer-learning (learning from formal and informal contacts with other participants happens spontaneously and intensively). This training methodology can therefore contribute to the building of a corporate identity or culture.

Pedagogical implications

Videoconferencing permits the easiest transition from traditional face-to-face classroom training and teaching to distance education. Instead of being in the same room at the same moment, the trainer/teacher and learners meet at the same moment but in remote places connected via high-quality telecommunication services. Lecture-based courses require minimal adaptation on the part of the lecturer and the course materials. The lecturer will need to learn how to deliver the lecture on camera and adapt the visual materials that he/she would normally show in the classroom (writing on the blackboard, notes, overheads, slides, etc.) in order to make them transferable by means of videoconferencing. Though not difficult, this conversion of teaching from classroom to telepresence should not be taken lightly: videoconferencing users often express their initial inability to find a successful style and method to deliver their lecture via videoconferencing. Therefore teachers and trainers starting to use videoconferencing for training, require some basic training in, for example, camera presentation skills.

Furthermore, the nature of the interaction with the remote learners, although present at the same time, is different from the traditional classroom interaction. The trainer will not have the same feeling of presence that he/she is used to. He/she will only see on the monitor what the camera picks up at the remote site and details or the trainees' body language may get lost. Because the camera may not show the whole classroom at once, the learners may not react or interact as if they were in one and the same room with the trainer, which can also cause difficulties. Depending on the level of interactivity the trainer or the course content requires, it may be necessary to include new pedagogical methods or mechanisms to provoke or improve interactions between trainer and trainees, or between the trainees themselves. These factors have a relationship with the size of the group participating. Although numbers may differ according to the nature of each videoconferencing session or course, it is generally accepted that group size should allow for interaction and for personal contact. When sessions require a high degree of interactivity, they are better limited to small groups (say 6 to 25 participants) while sessions where participants are required to simply passively receive information can of course tolerate larger audiences.

In the same way there is a limit to the number of sites that can effectively participate in a videoconference: where a high level of interaction between all participants is required the number of sites needs to be kept low (a common accepted limit is 5 sites). Once there are many sites involved, the quality of the interaction may suffer to such an extent that it is no longer cost-efficient to use videoconferencing. In this case the training manager may be better-off deciding to use pre-recorded video or video broadcast via satellite or terrestrial networks.

Audio-visual materials and teaching aids may require a drastic redesign (portrait format overhead slides may work sufficiently well in the classroom but will not pass convincingly via videoconferencing due to the resolution* and aspect ratio of

the image displayed). Designers of the teaching support materials require guidance to make a successful shift over to telepresence teaching and training. Objects and materials used in training sessions may also require adaptations or an approach that differs widely from the classroom use: hands-on demonstrations need to be organised differently (e.g. by distributing objects or samples to the remote classroom before the actual videoconferencing training session).

To a large extent the success of videoconferencing-based training depends upon the amount of care and attention that is spent on the physical environment or location of trainers and trainees and in the degree of planning and preparation that goes into the overall course and individual session. The environment needs to be made suitable for trainers who want to get across certain concepts and ideas to their learning community, where they wish everyone to receive the same message at the same time and where discussion and visual contact plays a role in the training scenario.

If the trainer wants to facilitate reflection whereby the trainee has a chance to consider the contents of a lesson and possibly make an individual response to the learning content, then means other than videoconferencing may have to be employed. Depending upon the size of the group participating in a session delivered via videoconferencing there may also be restrictions with regard to interaction; not every individual can have the same opportunity to fully participate in each videoconferencing session. Experience shows that mixing synchronous media such as videoconferencing with media that supports asynchronous* communication like a fully integrated e-mail* system are the most successful.

Critics of videoconferencing as a tool for learning point to the fact that this medium sometimes does little to shift the focus in training from being teacher-centred to being learner-centred; it simply mimics traditional teaching where the teacher or trainer is centre-stage, the so-called 'sage on the stage'. In the current climate where there is a noticeable shift in thinking towards a more learner-led approach focussing on the development of problem-solving skills amongst learners, this can be problematic. However this criticism does not take into account the fact that with a little imagination and a sound technical set-up, videoconferencing can indeed be used to support a more learner-led approach and can be used as a way to support the development of problem-solving skills amongst learners. It is not a medium that suits a simple 'lecture' type approach because of the negative effect this will have upon learners' attention span. This means that in order to use the medium most effectively, trainers and teachers find themselves having to include group work, discussions and other devices that focus more on the learner.

In addition, the fact that videoconferencing closely resembles traditional teaching means that it can be used as a first 'point of entry' for teaching professionals who are reluctant to adopt new Information & Communication Technologies (ICT*) tools for teaching. Many trainers find themselves using videoconferencing on the understanding that it will require them to make only minimal adaptations to their normal way of teaching. Once they have begun to use this technology then the transition to other technologies becomes easier as they realise that adapting their teaching approach can have a highly beneficial effect on both their teaching and its use and value to the learning community.

Conditions for successful implementation of videoconferencing as an instruction tool

- Take time and make resources available to orientate, familiarise and train all participants in training sessions that use videoconferencing as a communications medium.
- Ensure the appropriate technical quality level; for example, if the training content requires a high standard of video projection to show certain types of images, then this should be of high priority to those setting up the system in the first place.
- Support trainers in their preparation of sessions by ensuring an adequate level of technical support.
- Build in sufficient variety and visual interest in sessions to ensure that the limitations of videoconferencing do not interfere with the learning process.
- Provide a mechanism whereby participants can have access to slides and other support materials after each session as well as some form of ongoing asynchronous communications between both the trainer and trainees and within the trainee community.
- Put in place facilities which allow the trainer maximum control over the session, this means a fully ergonomic and user-friendly teaching position.
- Ensure sufficient resources and personnel in all participating sites to support the learning process this includes facilitation in all remote sites.

TECHNICAL IMPLICATIONS

Putting in place an effective videoconferencing network for learning implies the installation of equipment in all participating sites as well as ensuring that there is a network available, which is reliable and allows the required communication bandwidth.

Equipment

For training in classroom type environments (with groups of learners) it is most often necessary to adapt an existing classroom to accept the additional audio-visual means in use with videoconferencing. Sound-proofing and controlling the lighting conditions (blocking outside light coming into the classroom and lighting the learners' environment comfortably) are more demanding than in the traditional training room. The choice of audio-visual peripherals (TV monitor or video projector, camera(s), microphone(s) and sound playback) should be taken carefully and in coordination with experienced videoconferencing system installers. The videoconferencing codec itself is a black box, sometimes called a rollabout*, that has two different functions: it controls all the video and audio inputs and outputs, it also controls the connection with the remote site.

For single users, the videoconferencing terminal can be less complicated and miniaturised and consequently integrated in the end-user's desktop PC. There exist hardware (PCI card-based) as well as software-based videoconferencing codecs that may fit on the PC. Their performance will however not be comparable to the large group systems. In addition to the codec the multimedia PC needs to be equipped with one or more cameras, speakers or a headset and a microphone. The nature of

PC-based videoconferencing allows easy sharing of documents and applications on the desktop. The software that handles this functionality is mostly integrated in the videoconferencing set-up.

Network

Videoconferencing usually takes place over leased lines*, over ISDN* or over LANs*. These networks guarantee a certain bandwidth and therefore the quality of the audio and video can be accurately predicted or scaled according to the requirement: more bandwidth can be used when higher-quality images are required, the bandwidth (and the cost) can be decreased when the image quality is not important. These networks also provide reliable connections: videoconferences between two or more participants can be planned accurately and are not hindered by any temporary lack of bandwidth as occurs on the Internet.

Cost implications

Setting up the videoconferencing system

The classroom-type videoconferencing set-up (or group system) is of course more expensive than the PC-based videoconferencing system. This is not only because all the integral components are of better quality and functionality but also because the classroom set-up will put higher requirements on the room in which it is being set up. The total cost of the videoconferencing set-up should therefore take into account all possibly required adaptations to the classroom. Another major cost factor is the typical nature of videoconferencing in a company or institution: you may have to decide to install not one but many similarly configured systems in many or perhaps all of your locations.

Table 8: average cost of videoconferencing group systems (EURO)

	Maximum (EURO)	Average (EURO)	Minimum (EURO)
Codec	50,000	30,000	10,000
Audio-visual equipment	25,000	15,000	5,000
Room adaptation	50,000	27,500	5,000
Telecommunication networks installation	1,000	600	200
Total	**126,000**	**73,100**	**22,200**

Table 9: average cost of desktop videoconferencing systems (EURO)

	Maximum (EURO)	Average (EURO)	Minimum (EURO)
Multimedia PC	3,000	2,000	1,000
Codec	2,500	1,250	0
Audio-visual equipment	1,000	600	200
Workplace adaptation	1,000	500	0
Telecommunication networks installation	600	400	200
Total	**8,100**	**4,750**	**1,400**

(Please note: prices are purely indicative and based on average market prices in the European Union.)

Using videoconferencing for training

Operational costs depend on a number of factors: how much preparation does it take the trainer for each of the sessions, how much course adaptation and consequently audio-visual and technical support is required to convert the training materials into course content that fits this particular medium? Another cost factor relates to the nature of the communication network being used to link the remote sites. Is this private (e.g. the existing corporate network) or is it the public network? If it is to be the public network then you may choose to use ISDN because in that way you are guaranteed good-quality connectivity. Converting your telephone system for videoconferencing purposes will come at a certain cost. If, however, the quality of the connection is not so important then you may choose to use the Internet as the connecting network. Be aware of the fact that the Internet guarantees neither connection nor quality.

Where are the remote sites actually located? Be aware of the cost differences between local and various international tariffs.

When using the public (ISDN) network, connection costs may differ widely from country to country. The cost of the ISDN connection will also depend on the bandwidth you choose to use. Many people argue that effective videoconferencing requires a 384 kbps* connection. However in the authors' experience 128 kbps has proven to be sufficient quality for videoconferences where image quality is less critical (e.g. 'talking heads').

When connecting multiple sites at the same time, the issue of bridging between the sites will enter the equation: Multipoint Control Units or MCUs* allow you to connect multiple sites to each other at the same time, but they will add to the overall cost of the operation. There are two aspects to this cost: there is the cost for equipping and connecting each additional site and the overall cost of using the MCU*.

An in-depth costing study taking into account the specifics of your training proposal may need to be carried out before planning the implementation of the videoconferencing network within the company. Such a study will also clearly point out whether videoconferencing will need to be complemented with other systems such as e-mail which can provide an asynchronous connection between the trainer and trainees.

Case study

Pentalfa, Medical Faculty, K.U.Leuven, Belgium[7]

Pentalfa is a large-scale project of the Medical Faculty of the Katholieke Universiteit Leuven (K.U.Leuven) and functions as a support mechanism for the continuing education of medical specialists in Flanders, the Dutch-speaking region of Belgium. Work on Pentalfa within the Medical Faculty began in 1998 and is ongoing. During the 1998-1999 period, 9 sites, most of them hospitals, were involved.

Background of the project

The main purpose of Pentalfa is to provide continuing professional development opportunities for medical specialists in the Flanders region using telepresence. Many of these specialists are in fact graduates from K.U.Leuven's Medical Faculty and it is with the intention of supporting these alumni that the project was instigated. Traditionally these specialists have attended educational evenings

[7] Case study quoted as part of final report of Blueprint for Interactive Classrooms (BIC) project, supported by European Commission Telematics Applications Programme. Full report available on BIC web site at: http://www.avd.kuleuven.ac.be/BIC.

Videoconferencing in the Pentalfa auditorium

organised by various institutions, but this has frequently involved a great deal of travel and subsequently time away from work. The Pentalfa project was initiated in an effort to augment and, in some cases, replace such face-to-face educational opportunities. A sponsorship plan was put in place involving the D. Collen Foundation, AVdienst K.U.Leuven, and various pharmaceutical and IT/Telecommunications companies (e.g. the sponsoring companies pay communication and catering costs). Each week during traditional university term time, there is a multi-point videoconference dealing with a different medical topic, consequentially a different set of experts and a different audience.

The science of medicine is developing extremely quickly. Therefore, doctors and specialists are required to continually attend training courses in order to stay up to date. By law in Flanders, a doctor is expected to earn a certain number of points in a regionally administered educational system each year. The Pentalfa videoconferencing sessions are recognised as legitimate continuing education opportunities and doctors attending are accredited accordingly.

Each session lasts about 2 hours in the evening and is preceded by a welcome and registration session organised in a similar manner in each of the participating sites. For each session, a topic within a specific discipline is chosen and treated in a multidisciplinary way. This makes it interesting for a large group of specialists from different disciplines. Each session consists of 4 or 5 presentations (usually with audio-visual support), of 20 minutes each, followed by a short interactive session for raising points of view, clarifications, questions, etc. Finally, there is a panel discussion between the speakers and the participants of all the sites. In each site, a peripheral moderator coordinates the session (especially the discussion). A central moderator, in Leuven, coordinates the whole evening and is responsible for it. He/she usually brainstorms beforehand with the different speakers in order to realise the final agenda.

An auditorium of the Teaching and Research building of the K.U.Leuven Hospital Gasthuisberg has been completely reorganised and adapted to deliver these sessions

via videoconferencing with the latest state-of-the-art technology. Each of the participating hospital sites is also equipped with a fully integrated mobile system for participating in these sessions. The technical infrastructure consisted of the following elements:

In all auditoria (the central one in K.U.Leuven and the 4 remote sites), the session can be followed on two screens. On one, either the speaker/moderator or person involved in dialogue at a remote site can be seen or whatever else is being sent via videoconference (image from overhead camera, video signal being sent from central location, etc.). On the second one, which is linked to a multimedia computer, digitised images are projected. Very high-quality projection equipment is used in order to provide the highest-quality visual images.

Two cameras are set up in each site: one on the speaker and/or the moderator, one on the public.

It was decided to utilise 384 kbps ISDN connections (6 lines) between all sites linked via a videoconference bridge* located centrally. The bridge allows either the speaker's single site to be shown to all other sites at the one time or an image showing four of the remote sites. Switching is done centrally and in consultation with both the overall session moderator and the presentation speaker.

A further 128 kbps ISDN connection (2 lines) is used to trigger locally-available audio-visual presentations for each of the speakers. All speakers are encouraged to convert their normal audio-visual presentations into Power Point files which are coordinated beforehand in order to ensure a house style and to ensure the audio-visual quality of all presentations. QuickTime* movies can be incorporated into these presentations if necessary. The coordinator of this aspect - the central technical moderator - collates the various presentations for each evening's session (requested two weeks in advance) into CD-ROM format and distributes a copy of the CD-ROM beforehand, which is loaded onto a multimedia PC at each participating site. The reason for such a high-quality and relatively complex approach is due to the specific requirements of those taking part for display systems capable of showing complex visual material.

In addition a document camera is available in each site, where slides can be shown, or extracts from books, pictures, radiography, and videotapes.

In each site there are 60 handsets or keypads that incorporate both an individual microphone and the response controls. The responsive system is used for participation at various moments during the programme when individual responses are sought: quizzes, polls, etc. When a participant wants to ask a question, he/she can hold up the same handset and the camera zooms in his/her direction. When a speaker wants to know the participants' opinion about some subject, the response system can be used. The output of each keypad is relayed locally via infrared and then to the central control site via the 128 kbps* ISDN line.

Reactions of participants

In general terms, participants are satisfied with the pedagogical approach used in Pentalfa. They see videoconferencing as an efficient tool to transfer, understand, memorise and apply information in their daily work.

The evaluators find that young doctors do not usually see differences between videoconferences and face-to-face seminars. But for more mature professionals, who are more used to classical face-to-face lectures, the quality of the sessions (presentations, documents, etc.) is much appreciated. The transparency of the

technology, which was well organised both in terms of conception and realisation, allows both speakers and participants focus on the content of the seminar and there is little evidence of any technical disruptions. Participants also find the voting system easy to use.

The Postacademic Interuniversity Courses in Information Technology (IT) and Telecommunications (Telecom), Belgium [8]

[8] From the website: http://www.ivpv.ftw.rug.ac.be/infotec/ and http://www.imec.be/seminars/itc/

These two postacademic courses have been run since 1997 in Flanders, Belgium by a consortium of companies, universities and EuroPACE. They were developed in order to meet the training needs of engineers in large companies active in an organisation called FABIT (the IT division of FABRIMETAL, the Belgian employers' association of the metallurgic industry). The demand for these courses is driven by industry, mainly due to the fact that it is facing an urgent need for engineers with an up-to-date knowledge in both areas. It is generally agreed that the speed at which technology is evolving in the industrial environment is being slowed down by the lack of highly-qualified engineers. This shortage is especially visible in enterprises that work with telecommunications or software engineers.

From the start the companies clearly stated that the end-users needed high-quality courses resulting from close inter-university cooperation. A programme committee, in which representatives of both universities and industry participate, designs and monitors the content of both courses. Industry's role is to ensure that they have practical relevance and immediate applicability in the daily work of the engineers. Lecturers within both courses are primarily recruited from the participating universities and are professors at the leading edge of development in these fields. Experts from industry are brought in as well, albeit to a lesser extent. EuroPACE provides technical and operational support. These courses represent the first time in Flanders that cooperation at a university-industry level on such a large-scale, accredited and long-term educational programme has taken place.

The IT and Telecom courses focus on personnel with scientific skills searching for either an update on the latest issues in Telecommunications or Information Technology, or a full reconversion towards a telecommunication or IT job. This target group includes employees of telecommunication-related companies, university and polytechnic students preparing for a doctoral degree, and teaching and scientific staff of universities and polytechnics. To date 500 students have participated in the Telecom course, and more than 1,000 in the IT course.

Both courses are delivered through videoconferencing. The sites (7 for the Telecom course and 11 for the IT course) are connected through 384 kbps ISDN videoconference, switched by a multi-point bridge. All courses are conducted at the campus of one of the participating universities and are transmitted by videoconferencing in real time to other universities and a number of industrial sites throughout the country. One of the industrial sites broadcasts the signal to several other plants all over Europe.

Learning materials are the (intangible) lectures delivered during the videoconferencing sessions, for some modules the lecturer refers to additional course notes or handbooks. These lectures are supported by printed versions of the Power Point presentations used by the lecturer. The printouts are made available to all students. Other learning materials include the preparation materials, the output and the evaluations of project-work, case studies and the laboratory sessions.

The Telecom course is coordinated by ESAT (the Department of Electrical

Engineering of the K.U.Leuven), and is a cooperation with the universities of Ghent, Leuven, Brussels, Limburg and Antwerp, together with companies active in the FABIT sector (Electronics, Information Technology and Telecommunications). Lecturers are selected from universities, IMEC, polytechnics and industry. The course, given in English, is scheduled for 70 weeks over two years, with a three-hour lecture given via videoconference twice a week.
The curriculum of this course gives a complete overview of the technological aspects of telecommunications. Students have an option to receive a Master's Degree in Telecommunications. For this course the original idea was to offer the students a connection to a computer conferencing system, and let them interact with each other; but the administration of more than 500 users in a closed and protected environment was seen as putting too much of a burden on the organisers of the course. Therefore e-mail as a one-to-one communication medium was chosen. Students have available lecturers' e-mail addresses for communication. Alternatively, they can also send all questions (both generic and content-related) to a central e-mail address from where the mail is forwarded to the appropriate person.

The IT course is jointly organised by a consortium of the universities of Ghent, Leuven, Brussels and Antwerp and coordinated mainly by the Institute of Ongoing Education (IVPV-FTW, Ghent University, and Faculty of Applied Sciences). Companies in the IT and Telecom industry support it to a great extent. The course is scheduled for 87 weeks over two years with a three-hour lecture given via videoconference twice a week. The course includes 417 hours of lectures, 87 hours of project-work in the laboratory and 120 hours of homework assignments. For each student, a final test/evaluation is scheduled per module; the successful students receive an official postacademic certificate, granted and signed by the four organising universities. For this course a number of mailing lists were created. Using these lists, communication between the students of a specific course is supported as well as communication with teachers, coordinators and organisations. There are 9 public mailing lists: seven for the each of the different course groups within the course, one for the lab assistants and a list for general information and announcements from the course secretariat for course students and local coordinators. All mailing lists (except the 'general list') are unmoderated and open. The list 'assistants' is meant for the lab assistants only. The 'general' list is a moderated list and is used only for announcements from the course secretariat for course students and local coordinators. Every mailing list is digested and archived.

The benefits of videoconferencing perceived and put forward by the course organisers are that videoconferencing:

- is a cost-effective way to bring people together without the cost and time-commitments of travel;
- allows a large number of people to be reached simultaneously;
- provides widely dispersed groups with access to specialists or experts;
- allows for a genuine dialogue between participants;
- allows teachers to provide live visual demonstrations of specific topics;
- allows direct two-way communication of content, pictorial objects, etc.;
- provides scope for the creation of a learning community;
- provides a sense of social presence;
- facilitates more effective cooperation between different institutions and companies.

Advantages

Videoconferencing allows concepts, ideas and problems to be discussed between participants where face-to-face meetings are either impractical or impossible to arrange. Of any of the new learning and training technologies, training using videoconferencing is probably the closest to a traditional face-to-face learning experience. Used effectively, videoconferencing allows the trainer to show and discuss all manner of topics in real time with full audio-visual support. As it is a synchronous medium, learners can participate fully with the trainer or session leader as well as one another, and for many trainers videoconferencing is an acceptable first step towards using Information & Communication Technologies (ICT*)-based technologies to support learning as it requires only limited adaptations to their normal ways of teaching.

Using videoconferencing can have important cost implications and can allow organisations to replace expensive travel and subsistence costs usually associated with providing centralised training services with a distributed system based on a network of videoconferencing facilities in different locations. In this way videoconferencing can be seen as a way to bring training to the trainees rather than the other way around.

Disadvantages

Videoconferencing can be expensive to set up, equip and use properly (though it is important to point out that costs have been falling in recent years) which can put off some organisations. There are also important training implications as it does require both the trainer and the trainee to make a number of key adjustments to their usual way of both leading and participating in training sessions. Experience shows that training sessions via videoconferencing requires there to be more variety and visual interest than in a comparable face-to-face session. Trainers need to understand how to plan both sessions and support materials to take into account the typical disadvantages of using videoconferencing systems, such as poor video image, inability of the system to handle spontaneity during a session, lack of real contact between sites, etc. The level of planning and organisation required as well as the technical interfaces* may take away some of the spontaneity and improvisatory qualities of the training.

Participants also need to be taught how to interact effectively as they can often be 'put off' using videoconferencing for interactive purposes and experience shows that is useful to include other communications means between trainers and trainees like e-mail in order to overcome this difficulty. Although potentially very useful, particularly where the participants already know one another, videoconferencing never fully replaces the face-to-face experience.

KEY DECISION-MAKING ISSUES CHECKLIST

Now take the time to read through the following checklist, to see if training using videoconferencing is right for your organisation. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues.

- Do you need to interact directly with the other participants via speech and images?
- Can the main content of your course be delivered in a 'show and tell' scenario?
- Is it necessary to have direct group or person-to-person discussions?
- Can all participants be brought together in one or more locations at the same moment?
- Are good-quality telecommunication services available in all locations?
- Have you suitable quality videoconferencing equipment available in all locations that you wish to bring into the training network?
- Can you support the conversion of course materials and the training of all stakeholders?
- Are your trainers willing to take part in a training course and, if necessary, make adaptations to their style and way of doing things?
- Are the locations that you wish to adapt for videoconferencing use suitable for such adaptation?
- Do you have sufficient expertise in-house or available to your training department to ensure the successful integration of videoconferencing within your training organisation?

Chapter 4

Electronic mail

Introduction

This chapter will deal with electronic mail, from now on called e-mail, first as a generic electronic communications application and then as a tool for learning. It will equip you with basic information about how e-mail works and how you can use it as an effective way to support your company's training system.

E-mail was one of the first uses of the Internet and is still the most popular single application. A large percentage of the total Internet traffic is e-mail: it is estimated that in 1998 some 3,400 billion e-mail messages were sent across the Internet in the US alone. E-mail services are often provided both as part of a global e-mail system supported by the Internet, and for internal use on private networks. Used internally, these networks (commonly called intranets*) are used by a company for private, internal company messaging and file exchanges. If the company is geographically distributed on more than one location then the company intranet will link each location but may still remain private to the company and not be installed with a gateway to the public Internet. Therefore e-mail is not always used as a connection to the outside world. Many banks for example use e-mail only for internal communications purposes and do not extend their internal intranet with an external gateway to the public Internet, largely for security reasons.

E-mail can be used for training purposes to support the interaction between tutor and learners, between learners and as a way in which learners can access advice and outside sources of information to support the learning process.

Generic discription

E-mail (electronic mail, sometimes also spelled email) is the exchange of computer-stored messages over a communications network. Messages are stored as ASCII* text. Non-text files such as graphic images, programmes and sound files, etc. can be attached and sent as binary data. Messages can be notes as entered via the keyboard. Messages can also consist of files that already exist.

Most mainframes, minicomputers and computer networks have an e-mail system. Some e-mail systems are confined to a single computer system or network, but others have gateways to other computer systems, enabling users to send e-mail anywhere in the world. Most companies that are fully computerised make extensive

Networked communications

With a desktop computer, you can do word processing, manage your finances, or use many other types of applications; no special additional hardware* is,t* software) installed on it - such as an e-mail programme, a web browser*, or some other specialised software. The person you are communicating with needs to have a similar set-up on his/her computer.

Between the two of you, on the network, is a computer called a server* that has software that manages the communications process (server software). Typically, end-users do not ever have to be concerned with servers; once you are connected to the network and have some sort of communications software installed on your desktop computer, you are ready to go. Almost all communications software - whether that is e-mail, web-based, or other types of programmes, like desktop videoconferencing* - works according to this same client/server* model.

Table 10: networked communications

use of e-mail because it is easy to learn and handle, fast, cost-effective, flexible, and reliable. E-mail is intrinsically safe when used with minimal caution: attachments on the other hand should always be handled with extra care.

The basic concepts underlying e-mail are similar to those associated with ordinary postal mail. People use an e-mail address to identify a location where they can receive messages. The messages are held at this address until they are collected. There are sets of computer communications protocols* that act as both the post offices and delivery mechanisms for e-mail services.

Although different e-mail systems use different formats, there are some standards that are making it possible for users on all systems to exchange messages. The CCITT* standards organisation (nowadays called ITU-T*) has developed the X.400* standard, which attempts to provide a universal way of addressing messages. The de facto standard however seems to be the Simple Mail Transfer Protocol (SMTP*). This de facto addressing standard is the one used by the Internet system, simply because almost all e-mail systems have an Internet gateway.

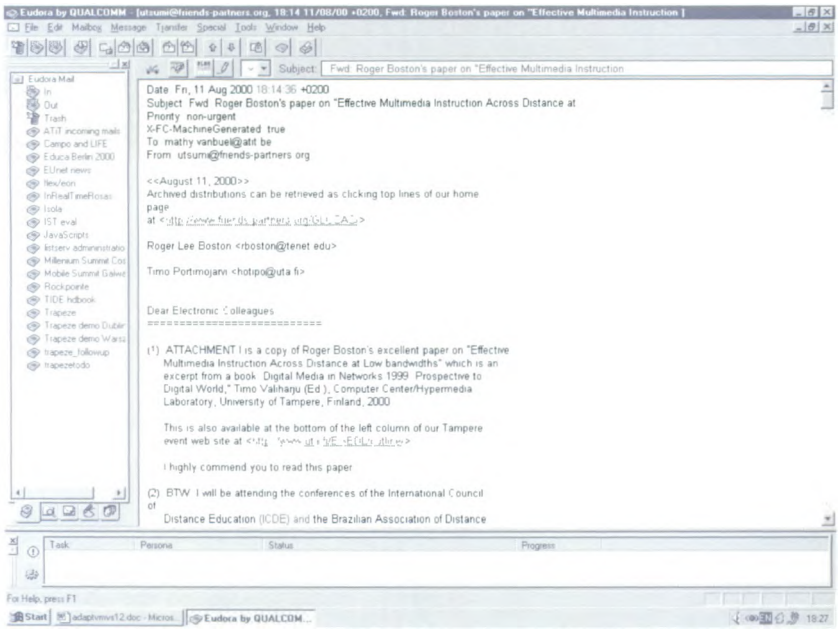
Simple Mail Transfer Protocol (SMTP)

Within the TCP/IP* set of protocols that bind the Internet together, there is a subset of computer communications protocols that are referred to as Simple Mail Transfer Protocol (SMTP). SMTP, as the name implies, is responsible for the transfer of mail across a network. SMTP is based on end-to-end delivery - which means SMTP systems will try to send the mail directly to the destination mail server, and keep on trying until it is successful.

Once the mail reaches the dedicated server it needs to be collected by the individual. This is also governed by communications protocols - two of the most popular being POP3 (Post Office Protocol 3) and IMAP* (Internet Message Access Protocol). These two protocols work in different ways. POP3 downloads* mail from the mail server to a local machine and sends any mail that was stored on the local machine on to its destination. IMAP allows the user to examine the mail while it resides on the mail server. With IMAP, all mail is not necessarily stored on the local machine.

Table 11: SMTP

Most e-mail systems include a rudimentary text editor for composing messages, but many allow you to edit your messages using any editor you want. You then send the message to the recipient by specifying the recipient's address. You can also send the same message to several users at once.



E-mail client window

All online* services and Internet Service Providers (ISPs*) offer e-mail, and most also support gateways so that you can exchange mail with users of other systems. Usually, it takes only a few seconds or minutes for mail to arrive at its destination.

E-mail is a particularly effective way to communicate with a group because you can broadcast a message or document to everyone in the group at once. E-mail messages that have been sent are stored in electronic mailboxes until the recipient fetches them. To see if you have any mail, you may have to check your electronic mailbox periodically, although many systems alert you when mail is received. After reading your mail, you can store it in a text file, forward it to other users, or delete it. Copies of memos can be printed out on a printer if you need a paper copy.

E-mail tools

E-mail itself is the simplest form of online communication; it allows the exchange of text between two or more users. You can store e-mail messages on your local computer and sort them by date, subject, sender, or other categories including those relevant to your learning environment, like 'Reactions to assignments from tutor', 'Communications with other learners in project-work group', etc. Most e-mail programmes allow attachment of documents of any kind, but difficulties sending attachments successfully from one e-mail system to another are not uncommon. In addition, if the attachments get through intact, recipients within the learning environment must have the appropriate software on their local computers to be able to 'open' the attachments. Like other forms of online communication, because of the lack of vocal inflection, gestures, and shared environment, e-mail is not as rich a communication method as a face-to-face conversation, a phone conversation or a videoconferencing discussion. This may lead to difficulties when used in a learning context. E-mail discussion groups are well suited to information exchanges, which can be handled in a single session or take place over extended periods. Some common dedicated e-mail programmes are Eudora, Pegasus, Outlook, CCMail.

E-mail and the World Wide Web (WWW)

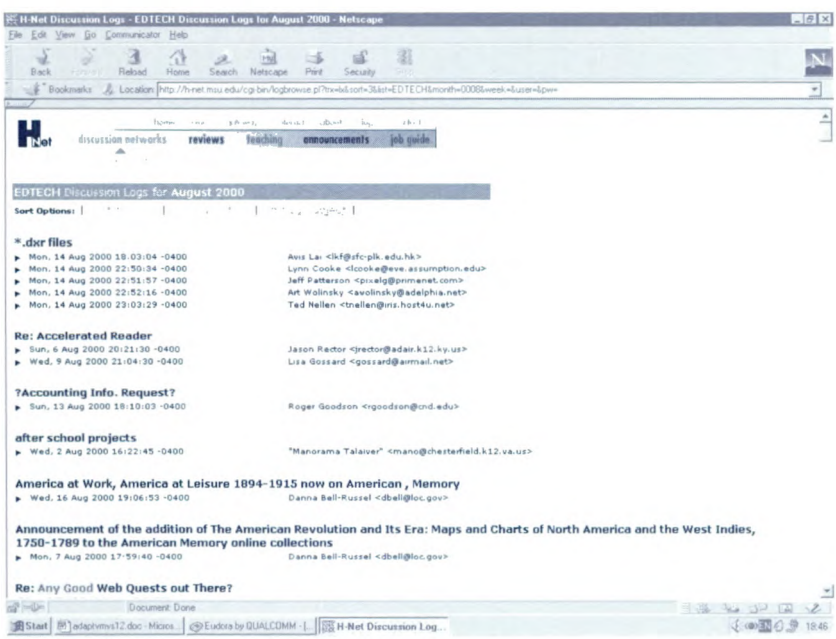
Because the World Wide Web has becoming a ubiquitous part of network activity, many recent versions of e-mail software allow you to click on URL* addresses sent as part of an e-mail text and automatically open your web browser to go to that address. Most web browsers like Netscape Navigator and Microsoft Explorer have built-in e-mail facilities, so it is easy to switch between applications within a single programme.

The advantage of dedicated non-browser e-mail programmes, on the other hand, is that they often have a greater selection of mail features than web-based systems (Return Receipt or Receipt Notification, address book facilities, threading and sorting, various attachment encoding options, etc.) The disadvantage is that you have to switch back and forth between two programmes: e-mail and your browser.

Threading

Threading in particular is considered a useful tool in e-mail based communications: most e-mail applications allow you to sort the messages you receive according to their originator or better still according to their content. E-mail discussions in which many participants are involved become much more comprehensive because the thread of the discussion is easier to follow.

Tools for archiving e-mail



Web-based e-mail repository

Even though e-mail is not organised by topic, its popularity has generated some efforts to create a way to organise messages by means of World Wide Web interfaces*.

Web-based mail interfaces	
Interfaces such as Hypermail and BSCW allow users to browse an archive of e-mail messages on the World Wide Web. This is a programme that takes a file of mail messages in UNIX* mailbox format and generates a set of cross-referenced HTML files that appear as a web page. Each file represents a separate message in the mail archive	and contains links to other messages, so that the entire archive can be browsed in different ways by following links. The archives can be updated, allowing incremental updates instead of rebuilding new archives from mail files. In addition, these interfaces will convert e-mail addresses and URLs within a message to hyperlinks so they can be activated.

Table 12: web-based mail interfaces

Mailing list servers

Mailing list servers (also called list processors, bulletin board systems and distribution lists*) are programmes that allow an administrator to create lists of e-mail addresses and attach them to a single e-mail address. All messages that are e-mailed to the list are distributed, again via e-mail, to all subscribers, sometimes by a 'moderator' who reads them first (in a 'moderated list') and sometimes automatically (in an 'unmoderated list'). Some mailing list servers require an administrator to add people to the list. In others, anyone who wishes can automatically subscribe (or unsubscribe) by sending an e-mail message to the programme, which resides on a server. Mailing list server programmes can provide some security by allowing only authorised users to post to the list or by using a moderator to approve messages before they are posted to the list. They can be a very useful tool for training as they allow the trainer/tutor to guide discussion and keep messages focussed on the topic under discussion.

List servers and distribution lists	
When e-mail is addressed to a list server, it is automatically sent to everyone who subscribed his/her e-mail address to that list. The result is similar to a Bulletin Board System or Newsgroup*, except that the messages are transmitted as e-mail and therefore available only to individuals on the list. A Bulletin Board System or BBS is a dedicated space within a server where users (clients*) can store messages that can be read by all other users (clients) of the BBS. Users can	also store files such as software applications in a BBS, which can be downloaded by others. Usenet (on the Internet) can be considered the largest existing BBS. Usenet is the name for the total of all newsgroups on the Internet. Usenet users can propose to set up message exchanges on certain topics: when sufficient interest can be gathered, a new newsgroup will be started. You can find newsgroups on virtually any serious or less serious topic you can think of: there are more than 10,000 newsgroups active.

Table 13: list servers and distribution lists

When you are considering discussion group tools, you may need to investigate the features of dedicated and browser-based e-mail programmes and determine what makes the most sense for your organisation, or you may leave the decision up to participants. One important decision factor here may be the current company culture and infrastructure. If your company or institution has already satisfactorily adopted a specific communication tool, it may be more effective to extend its capabilities to suit the training environment rather than imposing new or additional tools.

E-mail as a training application

E-mail is essentially a tool for communications and can be used on either a one-to-one or one-to-many basis for communications within the learning community, whether this is amongst a group of learners, between learners and trainers, or between members of the learning community and outside persons. The biggest advantage of e-mail is that it is the lowest common denominator of Internet communication and therefore will reach more people than any other medium; this gives it certain advantages over other communications tools in the training environment.

Pedagogical implications

E-mail isn't commonly used as a learning and teaching medium except in its role to support messaging. However it is also an important support tool for facilitating course administration, course delivery, assessment, etc. In that respect it can play an essential role by providing the communication mechanism and backbone for exchange of essential course materials (when they are formatted in a file format that can be attached to an e-mail message). E-mail is also an important tool in the development of a learning community. This is generally acknowledged to be an important aspect of the learning process for individual learners (creation of learning communities). Peer-to-peer learning and the social aspects of the learning community should not be underestimated.

An e-mail system can provide learners with a forum where they can exchange formal and informal information between themselves and with the tutors, teachers and trainers. E-mail provides opportunities for all kinds of asynchronous* communication. The learner and indeed the trainer can reflect upon what they read or receive via e-mail and react when and if they are ready to react. Experience shows that the quality of this interaction often proves itself to be more comprehensive and meaningful than synchronous interaction of the kind that takes place normally in the face-to-face situation.

The success of e-mail as a communications means is increasing exponentially. This has all to do with the low cost and with the ease of use. Too often however e-mail is still being used as an electronic replica of written or printed matters. This is a pity because print and e-mail are completely different tools. Style and content need to be adapted to the e-mail format in the learning situation. Here are some suggestions as to how e-mail can be effectively used for communications in a learning environment.

- Text on screen is harder to read than on paper (research by Dell Computers found a difference of about 25% in readability between screen and paper). However not all readers take the trouble to print the e-mail messages before reading. This should be taken into account when preparing the layout of your e-mail in order not to irritate or bore the reader.
- Another consequence of this reading problem is that readers tend to scan the text rather than read intensively. Another research finding (from Sun Microsystems this time) found that about 80% of e-mail readers 'scan' through a text looking for the keywords that provide them with sufficient information. The e-mail author can take this into account by providing the reader with a clear overview in keywords. For the same reason, numbered or bulleted lists are helpful.

- Start the electronic message with a table of contents or an index. This will give the reader an indication of what to expect or to look for.
- Keep it short: as a rule of thumb, be at least 50% shorter than you would be in printed matters. Use sentences with maximum 20 words, maximum 5 sentences per line, and maximum 4 lines per subject. If possible it is worthwhile to constrain your message to less than 400 words (this represents roughly the equivalent of two page-downs).
- If you have a lot of background information to provide, you can link the subjects within the mail to pages on a web site where you can expand the information in full.
- Keep your message informative and interesting: use e-mail only when you really have something to tell and give the reader an opportunity to unsubscribe from your mails. Also be aware of the fact that e-mails get forwarded very easily: you cannot foresee who will be reading your messages in the end.

Technical implications

Typical set-up requirements for an e-mail-based communications system include the hardware and software as well as some account management. Account management refers to the overall administration of the e-mail system. This includes making sure everyone who needs access to the system has access, that out-of-date addresses are replaced and that the overall system is fit-for-purpose, i.e. that it is sufficiently robust for the amount of traffic it needs to carry. All online services and Internet Service Providers and most in-company private networks (or intranets*) offer some form of e-mail, and most also support gateways so that the user can exchange mail with users of other systems. E-mail messages are stored in electronic mailboxes (or mail servers) until they are collected from there by the addressee.

E-mail addresses

E-mail accounts or addresses are assigned by the Internet Service Providers (ISPs*) or by the in-company network management according to the most common Internet or SMTP* standard (< name > @ < domain name >).

The less popular and less elegant CCITT X-400* standard e-mail address looks like this: (G = < firstname > ; S = < lastname > ; O = < dom1 > ; OU = < dom2 > ; PRMD = < dom3 > ; ADMD = < dom4 > ; C = < dom5 >).

Server side requirements

Windows NT, UNIX*, SUN, Apple Macintosh, LINUX computers and similar can be used to implement server software. The better-known major server products are AppleShare IP6, Microsoft IIS and Webstar. Care should be taken for server installation, operation, maintenance, updating, security and accessibility. It is important when planning to take into account your current and future server capacity needs as well as the appropriate access bandwidth*, particularly if you are planning to send or receive many large attachments as part of your training plan.

You can use either servers at the ISP* or you can set up your own e-mail servers at your own organisation's premises. Using the ISP mail servers has the distinct

advantage in that you do not have to deal with the management of the service. The ISP will take responsibility for monitoring the capacity of the server; the bandwidth of the connection to the Internet, the backing up and security of your messaging should be part of their regular duties. Setting up a mail server within your own company on the other hand is neither difficult nor expensive. Most servers provide you with an e-mail server application that is easy to implement. More important is the overall management and maintenance of the mail service: this includes account management, security, back-up and security of the messaging. This will certainly require resources within the company. While it is more interesting for smaller companies to rely on the ISP service for managing the e-mail, it may become more rewarding for companies with over 30 employees to manage their own e-mail services. Of course if you deal with highly confidential content, it may be considered wise, even for a smaller company, to have your own mail service.

Client side requirements

You will need a computer that is connected to a network, via either modem* (dial-up telephone, cable network, etc.) or a Local Area Network (LAN*) with a gateway to the Internet or to the intranet of your company that runs the mail services. In addition you will require a POP3 mail account (or IMAP4* if it is supported by your mail service) with an Internet Service Provider or on your local network service.

Plenty of e-mail clients are available for the end-user: CCMail, ClickMail, Eudora, LingoMAIL, MailEase, MailSites, Outlook, Paladin, Pegasus, QuickMail, Safe-Net Mail and Secure Mail are amongst the better known, some of them freely available on the WWW* or bundled in applications such as MS Office or operation systems packages such as Windows 95/98/NT4/2000.

Cost implications

If e-mail is not yet adopted by your organisation, it is probably the most cost-efficient ICT* application that you can implement. E-mail services can be applied in a gradual way, making it possible to invest along with the growth and the requirements. E-mail accounts are available for free from larger Internet companies such as Yahoo, Netscape, or even from Microsoft's MSN HotMail. Free accounts however do not give you the quality of service that may be necessary in your organisation. Some of these free services suffer from delays, limitations to the size of attachments or, in some cases, no attachments at all, and a not-inconsiderable loss of mail messages. There is no 100% guarantee in e-mail service that the message you have sent will arrive at the addressee, but the higher the quality of the service, the smaller the risk.

One step higher in cost is to subscribe to commercial and reliable or well-known ISPs that will allow you to use their servers for mail handling. This can be arranged under the domain name* for which your organisation applies. The cost for such an account is low and often is lost in the costs for the connection to the Internet that you have via either dial-up* or some other connection from your ISP. This cost can vary from about 100 to 1,000 EURO per year per account, depending on the level of service provided. Cost factors include for example the number of aliases that the user will receive with his/her account, the quality of the helpdesk and maintenance, the security of the service (service availability, rapid intervention, virus monitoring), size of storage and back-up, number of concurrent accesses to

the service, bandwidth of the connection, roaming and travelling support and number of Points of Presence. The latter can be interesting when your staff is travelling a lot and you want to provide them with roaming access to the Internet: some ISPs provide you with local phone numbers in many cities where you can gain access to the Internet.

When your company requires a large number of accounts, it is worthwhile to install your own server which will allow you not only to manage your own e-mail accounts, but also to set up an in-company mail system, and add other network services such as WWW, FTP*, etc. Depending on your typical situation and way of working, the installation of your own server can be profitable from 10 to 50 networked employees onwards. The installation of your own server, however, requires a company ICT policy (e.g. the employment of a dedicated ICT or network manager, the network connection to the Internet that becomes part of the overall telecommunications profile, etc.). The cost for the implementation of such services will range from 10,000 to several tens of thousands of EURO.

Another important implication to consider lies in relation to the costs of a moderator should you decide to implement a moderated e-mail list* server as part of your learning environment. Experience shows that such moderation can be extremely time-consuming if there is a lot of communication in a list. Invariably someone needs to manage this communication, ensuring it remains relevant, appropriate and timely. You will need to take into account the time needed and subsequent costs for moderation in such situations.

Conditions for successful implementation of e-mail as a learning application

- The system chosen must be easily accessible and intuitive to use.
- It must fit into the company's overall ICT strategy.
- Maintenance and updating needs to be of a level appropriate to the allocated resources.
- In order to ensure the success of discussion groups, it is important that they are an integral part of the course - for instance, material discussed in class is referred to in the discussion group and vice versa.
- One way to ensure the quality and value of e-mail as a tool is to put in place a system whereby the trainee cannot get a passing grade without completing whatever activities are assigned to be done in the threaded discussions.
- Trainers need to learn new student management skills, besides their subject knowledge and the ability to communicate their knowledge in order to make the most of opportunities afforded by e-mail and discussion groups.
- However if the trainee does not engage in the learning activity there is no way to force him/her. It is their life and it is their choice. If a student wants to learn the student will learn and will take all and every opportunity to do so.
- Activities must be meaningful and designed to engage the learners in analysis and synthesis - rehearsing what they are learning - and helping each other learn. The trainer or course facilitator must provide an initial structure for the discussions and the process should be a matter of discussion early in the course.

Case study

Management Development Programmes at Henley Management College, UK [9]

At Henley Management College in England, educational technology has been used to support management development programmes for the past decade. Initially seen as a means for reducing the isolation of the distance learner, it has evolved into an integrated learning environment where appropriate technologies have been developed for a variety of purposes. Henley uses Lotus Notes Groupware* extensively as part of these developments. (Lotus Notes is an example of a commercially available learning platform. Learning platforms will be dealt with in detail in the following chapter dealing with electronic learning platforms). The asynchronous* environments within the Lotus Notes learning platform support information sharing, dialogue, word processing and collaborative team working as well as reinforcing the wider learning community that Henley represents.

[9] As described at an international conference on Online Learning in 1998. Book of Abstracts - Online Educa Berlin 1998.

One aspect of the use of this technology, which has received particular attention, has been on applications that support the way in which learners independently reflect upon and review their own learning using e-mail applications, which is part of the overall learning environment that has been developed at Henley. The reason for this emphasis on reflection and review in Henley is clear. They believe that newly-appointed managers are often unaware of the guiding principles underlying their actions and Henley staff consider this a weakness in relation to the ongoing development of their own understanding of management theory as well as expertise in applying it. 'Double-loop' learning highlights the need for the learner, in this case the new manager, to be provided with the facility to engage in both a personal review of learning progress as well as an opportunity to have assumptions challenged.

Being part of an actively questioning learning group is identified by Henley Management College as being a particularly effective way of bringing about this challenge of assumptions. The challenge lay in finding a way in which technology could support this kind of group work based on message exchange on a one-to-one and one-to-many basis. What Henley did was to develop a mentoring environment that provides for both private one-to-one messaging which forms a kind of mentoring as well as, where appropriate, dialogue amongst a group of peers. In addition it allows new managers to build up their own knowledge base, constructing their mental models and then discussing their own observations and conceptualisations in the light of their own experiences. The opportunity exists for a review of learning facilitated by the use of Personal Learning Logs that in essence categorise the messages sent and received according to certain criteria that the learner can use when some critical incident has occurred. The structured learning review document that this provides helps the new manager to reflect on the critical incident as well as providing the mentor/line manager with information to form the basis for discussion and for feedback. Mentor/managers can access the learning reviews and engage in a private discussion on the issues raised. The manager's motivation to keep such a log is maintained through a schedule of mentoring sessions. Through the use of such technology, the new manager maintains a history of personal learning that can be returned to as a point of reference. It can also be used to form the basis of assessment against measures of national competence like those in the UK certified by the National Vocational Qualification Scheme.

Advantages

E-mail has a number of distinct advantages over postal mail, notably speed and convenience. A message can reach the other side of the world in hours, minutes or even seconds depending on the speed of Internet connection and degree of network traffic. E-mail messages are answered at the convenience of correspondents. Furthermore e-mail can be used to send a message to a number of people simultaneously, through the use of e-mail distribution lists*.

E-mail provides a quick and flexible communications medium for both intra-organisational and inter-organisational communications. The ability to attach files makes e-mail an efficient medium for distribution of electronic information. The use of distribution lists and list servers is another important asset of e-mail technology. Mailing list servers are an efficient way of sending e-mail to large and/or specific groups and are ideal for disseminating timely information, such as announcements of conferences, pointers to new web sites of interest, and descriptions of print resources. Anyone on the list can be a source of information. Mailing-list servers are well suited to groups of users who regularly use e-mail and who need to receive information in a timely way. E-mail is also relatively cost-effective and as it is increasingly available for normal communications purposes such as messaging in both business and everyday life, so it can be used for training purposes without additional significant expenditure.

Disadvantages

E-mail systems are not fully interoperable, despite development of various de facto standards. Not all organisations use e-mail either for internal or external communications, which presents problems when using e-mail as a standard mechanism for communication or messaging in the learning environment. Although e-mail tends to be faster than overland mail, an e-mail message is not delivered instantly and can be queued in systems for varying lengths of time. It may also be difficult to know for sure if your message has arrived safely on the desktop of the person for whom it is intended.

E-mail is also less effective for extended or lengthy discussions, because participants may not be able to remember all the previous entries when they respond to a particular item. Another disadvantage is that mailing list servers can be inconvenient for recipients, filling their e-mail inboxes when they are busy with other things.

KEY DECISION-MAKING ISSUE CHECKLIST

Now take the time to read through the following checklist. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues.

- Is an e-mail system already in place for your company?
- If so, can this system be used for training purposes?
- Do you wish to use an e-mail system with access to the outside world or will it be used purely within the company?
- Do you need to be sure your messages have reached the person for whom they are intended?
- Have you sufficient technical support particularly at the beginning to cope with the expected level of use?
- Do you wish to set up a list server for group discussion purposes?
- If you do wish to set up such a list, is this to be a moderated or non-moderated list?
- If moderated, are the person/s who are to moderate sufficiently skilled in online moderation of list servers?
- If not, have you a training plan in place for this aspect of your course?
- Have you sufficient resources to meet the costs of a moderator/s?
- Are the group discussions you have in mind sufficiently integrated into your overall training plan?
- Are your learners sufficiently motivated to use the system in order to reach the level and depth of communication you have in mind?
- Are all your potential trainees able to use the same tools for archiving e-mail messages?
- Is your system robust enough to handle the kind of communications traffic you have planned as part of your course delivery?

Chapter 5

Electronic learning platforms

Introduction

[10] This chapter is based to a large extent on the research carried out by Patricia Vandevelde for EuroPACE.

Electronic learning platforms are integrated digital* environments where the learning activity takes place. In other words these are the applications that are used for delivery of learning content and facilitation of the learning process. These platforms, sometimes also called virtual learning environments, are becoming more and more popular and increasingly dictate the kind of electronic learning platform that companies and other institutions create for their learners. They can be used to electronically connect learners and the training departments whether at the same location or dispersed over a wider area. Many electronic learning platforms have grown out of communication and collaboration tools with an important additional set of features and functionalities that make them more suitable for training purposes.

Almost all platforms currently available are based on a client/server* architecture. In many cases the client, located on the user side, is simply a web browser* that is used to access HTML* pages on the server*. While the majority of these platforms are embedded in the World Wide Web, in this chapter [10] we will focus more on a generic description of electronic learning platforms, while in the next chapter we will discuss the use of the World Wide Web for training in more detail.

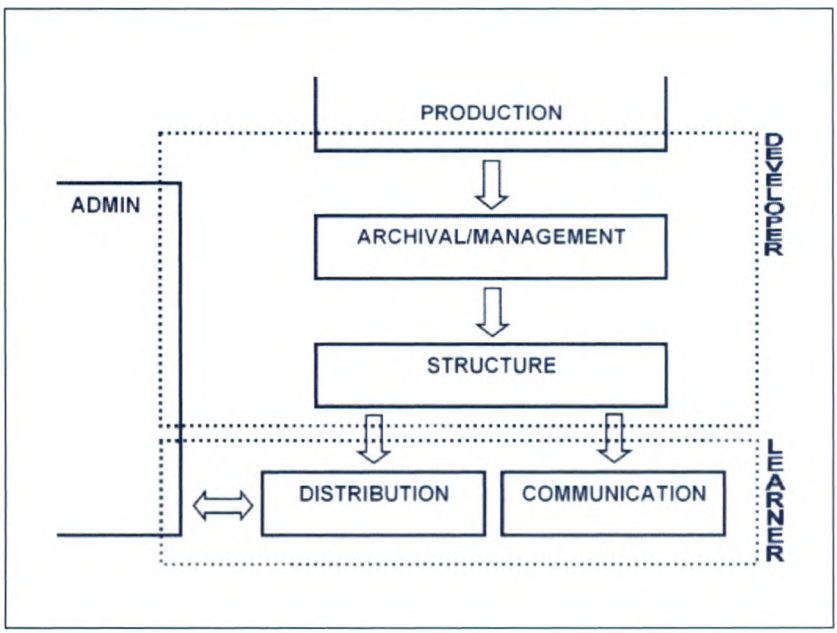
Choosing the right electronic learning platform for your Internet-based, collaborative training and learning environment is a complex undertaking. It is important to know that the perfect electronic learning platform for your needs does not exist (yet). In the selection of the platform you will therefore need to make compromises based on your own set of selection criteria that will guide you through the decision-making process. You will have to take into account not only the goals of the learning process itself, but also the technical know-how of all participants and 'physical' limitations, such as compatibility of computers and network or server capacity.

This chapter provides a framework for helping you decide on an appropriate platform given the many variables that must be considered. Keep in mind that there are still many products under development. It is a rapidly-evolving field that will most likely offer new products and services that have the potential to transform the current state of education and training. For this reason, we do not intend to go into the advantages and disadvantages of the various commercially-available products on the marketplace right now. We think it is preferable to give you a generic framework that you can use in your assessment of various options and suggestions in the resources, reading and reference list at the end of this handbook where you can get up-to-date information about specific products.

It is also important to note that it may not be necessary to adopt a learning platform. In some cases for example your requirements may already be met sufficiently by a simple web-based learning application (in the following chapter we will provide you with some more insight). Indeed some web site building tools already offer the possibility to build a fully-working training package. Two examples of such software tools are MS FrontPage 2000 and the combination Dreamweaver 3 with Coursebuilder. Training products created with these or similar packages can reasonably address the needs of individual solitary learners. However, it should be borne in mind that both social contact and collaboration greatly enhance the learning process. Instructor-led or tutor-accompanied courses provide a much broader social context within which learning can develop as a result of communication. This is exactly where fully-integrated learning platforms enter the picture.

GENERIC DESCRIPTION

All or some of the main functions it incorporates can basically describe the electronic learning platform. The following layered model which helps to describe and select electronic learning platforms is based on the work of Ir. Marc Ketels and Dr. Patricia Vandevelde, EuroPACE and K.U.Leuven.



Layered model of the electronic learning platform

Stage 1: production

Design and production of the learning materials

Learning content design and production is a process that is very dependent on the typical situation your training department finds itself in: it may rely on existing procedures, even on the resources in personnel and technology that are already available. When adapting, producing or collecting materials and learning objects, it is important to keep in mind the way in which they will be delivered. High-resolution* video images for example may not be accessible through your particular network and may require a different distribution medium (such as tape or CD-ROM*). For that reason, it is important to make sure that the learning content or learning object are output in standard formats that can easily be stored, re-accessed, and distributed, not only at the time of production but also in the foreseeable future. Many of these standards are not formal standards as such but rather industry-accepted. Some obvious examples of formatting standards are text standards such as Portable Document Format (PDF*), the document format (in Rich Text Format or RTF* or in Document or DOC format). Very important in the production of electronic learning materials has become the Hypertext standard HTML (or HyperText Markup Language). For images GIF* (Graphics Interchange Format) and JPEG* (Joint Photographic Experts' Group) are well-known and accepted. For video we find MPEG* (Moving Pictures Experts' Group), as well as industry standards such as QuickTime* video.

Production of learning materials is rarely a single person's job: it usually involves not only the course designer but a whole team of authors, editors, graphics and layout artists, audio-visual technicians, etc. Many of the skills required for high-quality appealing course content production will require specialist skills that may not be found in-house but may have to be subcontracted. The user interface* plays an important role here: is it easy to create new learning materials or to adapt existing materials? Can you use templates that are built into the platform and can you make use of your own self-created templates? Can the course designer and producer test the materials in the way the learner will have access to the materials? Are there clear guidelines and support tools to enable the course designer to make the best use of the platform?

Stage 2: archival and management

Storage, indexing and retrieval of the learning materials

Finding the appropriate system for the storage and retrieval of the learning content is key to the successful implementation of an electronic learning platform. Depending on the requirements of your own environment, the nature of the learning objects as well as the access means of all the users to this content, the learning content may need to be stored in specific database or server environments. Accurate indexing of the learning content and objects according to available standards (such as the IEEE* standard on Learning Object Metadata*) will enable high functionality in reuse, maintenance and accountancy of the learning content. The fact that learning materials can easily be adapted and reused in other courses using the same learning platform is an added value. While versioning should be simple, care should be taken however that the individual parts of the course can be stored securely: new or adapted versions should not affect the integrity of the original object. When choosing the learning platform, attention should be paid to the scalability of the database or server solution: will it be able to grow with the quantity of learning materials that you foresee? Can server access be upgraded easily when more users or subscribers are added to the learning platform? Some learning platforms are limited to a certain number of 'seats' in the classrooms,

Metadata

Metadata means simply information about an object. Metadata are important for indexing, categorising and searching for objects according to their intended use in a particular context. A sophisticated metadata set can encompass a wide variety of information about an object. For example, for a Java* applet that is included as a resource in a course unit, the metadata would provide information about who created it, when it was created, who the target audience is, etc. Most current platforms incorporate some simple scheme for providing metadata about resources, course units and people, however several systems that are currently under development are paying more attention to the metadata issue. To be truly effective any metadata scheme should be standardised in some way so that it can be used across different systems rather than being local to a particular system. For this reason standards efforts such as the IMS project initiated by EDUCAUSE in the US and the CEN/ISSS Learning Technologies Workshop in Europe are of particular relevance. See also the section dealing with standardisation later in this chapter.

Table 14: metadata

others may slow down when larger numbers of participants access its service. The structure of the server or database may also affect maintenance.

Multimedia resources

One major advantage of learning platforms is the ease with which multimedia* resources can be accessed and stored within the learning platform as an integral part of the course package. As more and more sophisticated educational materials such as interactive simulations and Virtual Reality* applications get published online*, the importance of multimedia facilities will increase dramatically.

Simulations	
Technical developments in computer technology have made simulations available to educators which are user-friendly and which do not require students to have a particularly high level of technical knowledge. Typical examples of the use of simulations in training are found in the aviation and nuclear industries as well as in banking and finance, where it is too dangerous, impossible or too expensive to train in real-life environments.	Simulations are useful in education because both the level of learner involvement (their interest in the information) and learning success are high. The quantity and quality of knowledge retained depends very much of course on the quality of the simulation. If a simulation can be found that comes as close as possible to reality, while at the same time communicating the theory normally acquired from lectures or books, then it is reasonable to assume that learning outcomes will be high.

Table 15: simulations

Virtual Reality (VR)	
Virtual Reality (VR) is a term used to describe computer-generated real-time interactive three-dimensional (3D) environments. The popular image of VR is a person immersed in a virtual world by wearing a headset and data glove. However, the majority of VR applications are based on desktop PCs or workstations and use the virtual reality systems as a 3D interface for complex interactive process simulation. VRML (Virtual Reality Markup Language) is a simple scene-description language that describes a 3D scene. It uses the HTTP* protocol of the World Wide Web and is written as simple ASCII* text. As a VRML world (3D scene) is loaded, the world format is interpreted in a similar way to a web page in that the scene is drawn on the screen. The user is then free to roam around the 3D model.	Virtual environments either aim to exploit the human ability to perceive large amounts of information as a 3D environment, or provide access into an environment that replicates some part of the real world that is either expensive or dangerous to experience. VR has been extensively used for training and simulation in application areas ranging from surgery through to flight simulation. VR is increasingly being used in construction industry applications as it provides a method for the designer and client to experience the building before it is constructed. Similar applications have been developed in industrial design as well as in the automotive and aviation industries. A typical example of the latter is where airplane cabin crew are trained in passenger management procedures for aircraft that are not physically available for training.

Table 16: Virtual Reality (VR)

Stage 3: structuring

Structuring and adapting the learning content into a course

Learning contents and objects need to be structured to result in a working course. Most electronic learning platforms currently available are generally based around either a 'Course Calendar model' or a 'collaborative/resources based model'. In the 'Course Calendar model' key activities and study resources are arranged by date and assessments and other activities become focal points or milestones in the learning path. This model comes closest to the traditional teaching model. In the 'collaborative/resources based model' the course content is the central theme of the learning taking place and additional facilities enabling collaboration and communication amongst the learning community are added in as required. This model lends itself more to self-acquisition of knowledge. In either case the course needs to be structured beforehand by putting in place the learning pathways (from setting the learning objectives to assessing the accumulated knowledge or skills), the content access framework and the timing issues. When selecting the learning platform, you should ask yourself if the platform would enable you to construct and even adapt learning pathways for your learners. In some cases, the trainer may want to alter the learning pathway for particular individuals or groups of learners. What are the auxiliaries the learning platform offers you to do so: can you assess the entrance level of your learners and alter the starting point? Can the course be adapted easily to learners with a different profile, interest or learning profile? For example: is the learning platform for your 'English for Business' course flexible enough to be adapted for technical staff as well as for administrative staff? Can the learning platform be adapted to fit the individual progress of different learners at the same time?

Course outline

The course outline or schedule provides an overview of the course structure and may include dates for assignments, assessments, lectures, videoconferences*, etc. Typically the system could provide a structured means for the tutor to create the course outline. The course outline will provide hyperlinks to the course pages. In a web-based system these will simply be HTML pages containing the material relevant to that part of the course. A calendar tool is a useful feature built into some, but not all, learning platforms.

Search tools

When a course structure becomes very large or there are several participants, navigating around the environment by browsing and hyperlinks alone can become quite cumbersome. Consequently some systems incorporate search tools in order to jump straight to subjects of interest to a particular person.

Book-marking

Like search tools for use on the World Wide Web, a book-marking facility can significantly decrease the amount of time spent navigating to frequently-used places or items within the environment. Some systems include a more sophisticated version of book-marking that allows participants to build up their own individual resource base.

Navigation model

Although navigation is not strictly a feature or tool within a learning platform, it is intrinsically part of the experience of using a learning platform. The navigation facility allows a user to move around the environment; the navigation model or

metaphor in conjunction with the look-and-feel of the system is extremely important as it defines in many ways how the system is used. In addition to using hyperlinks and page-to-page browsing which are common to the experience of using a normal web browser*, different platforms will present the tools available and course structure in different ways. Two popular models are to use a homepage* for the course which is presented on login with hyperlinks that act as jump-stations to the various tools that are available or, alternatively, to use a hierarchical tree structure. The two are often used in conjunction with the tree structure providing a course outliner with links to the course content packed into the branches of the tree.

File upload area

For truly interactive functionality, students should not just be recipients of content uploaded* onto the system by a tutor, but should be able to upload their own materials for other participants to look at. Some platforms include a facility for students to build their own materials and objects they have found into the learning environment.

Stage 4: distribution

Course distribution to the learner and support towards all aspects of the learning process

In the next level, the course needs to be made available to the trainees and the learners. This is not only by offering differentiated, reliable and secure access to the content, but also by putting in place mechanisms required to make the pedagogical process work effectively. In the first place the network infrastructure and the end-user hardware* must meet the content distribution requirements at all locations where the trainee is allowed or encouraged to study: be it at the workplace, in the training centre or at home.

Distribution of learning materials to the learner does include allowing the learner to keep track of her/his progress with regard to the contents and in time against the proposed course time schedule. It also enables him or her to save course annotations, possibly via links with the corporate networked server for storage and retrieval of homework and other resources. The course may need to be supported with a Frequently Asked Questions section, or even a helpdesk (by phone, e-mail or other). It may also be necessary or useful to incorporate some kind of search functionality within the course content. Is it easy to navigate through the course content? Can the way the content is displayed be adapted to fit the learners' taste and requirements (e.g. different screen size or resolution)? Is it necessary to use a proprietary client interface or is all the content accessible via common standard web browsers? Is it necessary to install specific software and hardware and does the course provision team support this installation?

Stage 5: communication

Providing communication tools to all end-users

The term 'end users' covers not only the trainees but also all other parties involved in the learning process: trainer, tutor, technical support people, administrator, etc. This is especially relevant with regard to the communications tools that are integrated in the platform. Communication tools are essential in the learning environment:: they serve to exchange information, feedback, assessment, etc. between all involved. The social aspect of learning should never be underestimated.

Sometimes specific communication paths need to be established between trainees, between trainees and trainers, between support people and others. Some examples of commonly available asynchronous* communication tools are e-mail, discussion fora with or without moderation and billboards. Asynchronous conferencing or discussion groups form the heart of many electronic learning platforms as they provide the means for students to engage in collaborative exchange about topics on the course. Another useful feature of a learning platform in that respect is getting to know the other trainees on a course or for tutors to get some idea of the students' backgrounds, interests and aspirations. Many systems incorporate a list of students enrolled on a course - perhaps with e-mail addresses. It is also useful to include a homepage* for each student. Some systems provide an easy-to-use front-end for homepage editing.

Will communication outside of the learning platform be possible and/or required (e.g. for access to external experts or external resources)? Are learners required to collaborate on shared documents and can the learning platform deliver common workspaces for this? It is an important advantage when the trainees during their course can make use of the communications system with which they are familiar in their normal working environment rather than having to adopt and learn an additional mail system. When the learning platform provides you with the communication tools, are they sufficiently functional and structured in order to support your goals (can you attach documents, track mail paths, flexibly create address books, etc.)?

Video- and audioconferencing, text and audio chat*, whiteboard and shared applications are examples of synchronous communication tools. They will put higher demands on the technology (especially on the telecommunications infrastructure over which the learning platform runs). Synchronous collaboration tools are a feature of some, but by no means the majority, of platforms. The relative importance of such tools in a system depends largely on the intended use of the system. By this we mean the ability to communicate in realtime, which may or may not be an important functionality for you in designing your overall learning environment.

Assessment should be easily integrated in different forms according to the type of content and your method of evaluating learning progress: does the learning platform allow multiple-choice questions, quizzes, free text and free drawing, time-limited questionnaires (drill), drag-and-drop exercises, etc.? Is the learning platform flexible enough to allow for practising the acquired knowledge at certain points in the learning path and for continuous self-evaluation as well as intermediate or final examination? Does it provide the course designer, the tutor and the teacher with sufficient means to construct assessment procedures at every level of the platform and with output in the detail that he or she wants? Does it allow for the integration of assessment modules and methods from external sources and does it allow for output of the results to external learner management systems? The course designer and provider should also take into account mechanisms for evaluation and feedback that cannot be automated as such, for example by putting in face-to-face meetings.

Stage 6: administration

Provide the administrative framework to the course

The organisational and administrative level of the electronic learning platform can offer the users clear access to the different courses offered and guidance to the

course proceedings. This can be done by simple means such as a course calendar, keeping up notice boards, etc. Typical course administration deals with the tracking of completed course work, the collection, recording and processing of results. Course administration should also allow for some kind of support to the overall course evaluation: are learners consistently running overtime, or are results below those expected? Furthermore, registration, accountancy and follow-up (accreditation, personnel performance recording, etc.) have to be administered, when possible even in conjunction with the overall corporate administration. Not all learning platforms will enable you to do all these tasks from within the environment. When you need these functionalities, you should investigate whether the platform allows you to export relevant administrative data in order to report and evaluate via other means. Finally, does the platform allow the administration to account course costs, etc. to the appropriate department?

Conclusion

Be aware of the fact that there are probably no learning platforms that will meet all the functionalities that are described above. In fact, you may only very rarely need most of these. It is therefore important for you to decide which functionalities you prioritise, which are redundant in your company, which are essential and which are not desirable in your environment. In fact you can decide not to implement a learning platform at all when you cannot see the added value it brings to your traditional training procedures. You may also decide that it is not a good idea to make the large investment required for a training and learning platform when you are not sure of the mid- or long-term perspectives of your training programmes.

Learning platforms as a training application

Why would your organisation implement a learning platform? Well-conceived computer-based training programmes are not only less costly to deliver than almost all other training applications (e.g. because they can be multiplied or repeated more easily) but also more effective because they will allow companies and training providers to respond more rapidly to procedural changes for which employees need training or retraining. The adoption of learning platforms will allow the integration of multiple objectives within one organisation (for example by combining Human Resource Management tools and applications with training and assessment tools, or by a better use of communications applications such as e-mail within the company). A good example of this is the Oracle in-company Information Management System that makes all information and training resources available through one single platform, resulting in what can become a Knowledge Management System that is accessible from within as well as outside the company. As a side result, the corporate knowledge becomes uniformly available, allowing for easier access and retrieval.

This is not the only added value of the use of a uniform learning platform. Potential advantages include the possibility to effectively integrate the administrative issues of course organisation such as enrolment, assessment, accreditation, accounting as well as of the support issues for the trainees, tutors and trainers. It enables a more effective follow-up of the trainee's progress during the course (by personalising and offering customised structures, methods and communication procedures) as well as in his/her career path.

Furthermore the administrative and organisational level of the learning platform should allow for controlled access procedures as well as for the secure and appropriate acknowledgement of access rights: trainers may need different privileges from the trainees, administrators and technical support people again will need a different entrance into the platform. In general, users of electronic learning platforms are divided into two main groups: Students and Tutors/Trainers. Sometimes you may need additional or other groups of users addressed or involved in the electronic learning platform: administrators, course designers, teachers, support staff, etc. Each of these groups may need a specific adaptation. While tutors may have a similar view of the system to students they will usually have additional tools and privileges that allow them to add materials, create conferences and track students' progress. In some cases students have an area for conversation that is private from the tutor's view.

How to select a learning platform?

The first main choice you face with regard to choosing an electronic learning platform is whether you create your own to specifically meet your needs and requirements or you buy one of the available existing packages. Building your own will generally allow you more flexibility and means that you are not dependent upon proprietary software that can be expensive. It also means that you can 'tailor-make' it to exactly meet your needs and this allows you to reuse elements or components from other groupware* products. However you should also be aware that building your own platform can be extremely resource-intensive and will require specialist technical skills. This in turn will have cost implications, and if you are not careful, the development process may become fragmented and indeed lengthy.

Some platforms offer extremely complex and multi-faceted functionalities while others are far simpler. In the resource, reading and reference list, you will find reference to various web sites where up-to-date information about platforms currently commercially available is listed. In the selection of the platform you will need to establish your own set of selection criteria that will guide you through the decision-making process. This set of criteria should take into account a number of different elements. First of all you should consider what learning and teaching activities are supported by the platform and what pedagogical and didactical flexibility it offers. You should also check your communication needs, the existing or achievable technical skills and resources within your company and whether it allows you sufficient support with regard to the overall management and organisation of your training activities. Finally you should take into account your budget, both for purchase and maintenance of either elements or of the whole learning platform.

In the following sections, we have listed many of the common types of criteria that people consider when making decisions relating to electronic learning platforms. We have classified these implications according to whether they apply to pedagogical, technical or budgetary aspects. Obviously some criteria will spill over from one category into another or have an effect on criteria from the other categories. In a typical integrated training application such as the electronic learning platform, no decision can be taken in isolation. Some criteria will relate to your situation, others will not; it is important for you to decide what your own selection criteria are in choosing a learning platform.

Pedagogical implications

First of all from a purely pedagogical point of view, some platforms allow you to add and change content as the course is progressing while others do not. Some provide you with templates for the inclusion of content that can be an advantage and a disadvantage depending on the way in which your course content is arranged. Some platforms support many different types of interaction with the content including direct links allowing a learner to complete an activity, the results of which are then communicated directly with his or her tutor. Others simply allow for automatic answering on the page itself. Some support multimedia* presentation of course content while others are purely text-based. Some platforms allow quite complex structuring of content allowing for multiple links and cross-reference possibilities, while others only allow material to be presented in a very linear fashion.

☐	Multimedia integration
☐	Access to multiple and diverse resources
☐	Simulation, games, role-plays
☐	Switching between learning strategies
☐	Tutor feedback
☐	Report generation (enquiries, surveys)
☐	Construction of different learning strategies
☐	Generalisation and multiplication
☐	Transition from teacher-led to tutored
☐	Process-based
☐	Task-based
☐	Independent learning
☐	Cooperative learning
☐	Learning pathways (individual/group)
☐	Planning and motivation building
☐	Study-skill building
☐	Progress assessment
☐	Flexible feedback collection
☐	Diagnostic test
☐	Built-in options (learning path selection)
☐	Tests and exams
☐	Accessibility (for persons with disabilities)
☐	Book-marking (ease of navigation: Internet location memory)
☐	Security (denial of access or excursion)
☐	Self-assessment
☐	Course building
☐	Course planning
☐	Course management
☐	Course customisation
☐	Course monitoring
☐	Instructional design
☐	Presentation
☐	Testing
☐	Online marking
☐	Record management
☐	Analysis and tracking of student-related data
☐	Curriculum management
☐	Knowledge building
☐	Team building

Table 17:
checklist of pedagogical elements for electronic learning platforms

The previous list should help you describe your learning platform. Decide which of the following elements you require and how best to describe the learning activity you wish to undertake.

Communication

Evaluate also each platform you are considering from the point of view of the communication options it offers and how these fit with the communications needs of your course. Are you interested in one-to-one, one-to-many and group communications? Does your course require there to be personalised guidance and if so does the platform selected support this? Is this guidance required only in relation to the content or does it also relate to the process of learning, i.e. do your tutors need to 'keep track' of a learner's progress through the courseware?

It is also important to consider what kind of feedback you need to support: is it text only or will it include sound and images, will they need to display graphics or share information synchronously (in real time)? Another important selection criterion to consider regarding communication is whether or not the platform you select needs to allow course participants to communicate with outside resources or experts. Will you need to archive conversations that will help participants identify issues and allow new members to catch up with the dialogue? Will your discussion have many sub-topics that will benefit from a hierarchical organisation (threading)? If your collaboration will be synchronous (real time), do you need a whiteboard feature? Are audio and video important?

☐	Asynchronous (e-mail)
☐	File exchange
☐	External communication
☐	Group communication
☐	Learner to learner
☐	Learner to teacher/tutor
☐	Learner to course administrator
☐	Synchronous (chat)
☐	Whiteboard
☐	Application sharing*
☐	Virtual working/learning space
☐	Group browsing
☐	Teleconferencing
☐	Videoconferencing

Table 18: checklist of communication options for electronic learning platforms

Ease of use

It is vitally important that you choose a platform that operates at a level of user-friendliness that suits your organisation and users, including all potential learners. This user-friendliness relates to accessing information sources and the way in which information is presented, how communication is facilitated and the way in which you are expected to administer a course from recruitment through to accreditation. User-friendliness also needs to be considered from the point of view of creating, changing and adapting content. Does the system allow you to easily add content, once the course has begun, for example? Can you structure a course with ease and does it allow you to use existing assessment tools, if that is what you would like to do?

☐ Standard hardware
☐ Ease of use of hardware
☐ Standard software
☐ Customising and individualisation
☐ User training and support
☐ Exchangeability learning materials
☐ Help functions
☐ Online/offline capabilities

Table 19:
checklist: ease of use of electronic learning platforms

Technical implications

When you decide to put in place an electronic learning platform there are a number of important technical implications. It is very useful to take the time to discuss different platforms with existing users, particularly where they are being used in similar training environments as the one you have envisaged. Because these platforms are increasingly complicated to maintain, repair and update, it is very important to have a good relationship with the supplier. Can the supplier assure you of ongoing support, software repairs and updates for the lifetime of the platform? What is the supplier's service turn-around time? Are there user groups that you can join? Is there a knowledge base or a Frequently Asked Questions list (FAQ) available from the manufacturer? Is there a developer's kit available that will allow you to customise? A number of the dedicated learning platforms currently available are extensions or elaborations of existing collaborative groupware*. Lotus Learning Space for example is a specific product designed for learning based on an existing tool, Lotus Notes, used mainly in the business communications world. Selecting such a platform may not only assure you of long-term support and further development but may also fit into your company's overall communications or ICT* strategy.

Here again is a list of criteria you should consider.

☐ Server platform hardware requirements
☐ Client platform hardware requirements
☐ Operating system/cross platform

Table 20:
checklist of technical criteria for electronic learning platforms

Organisation/registration/administration

Do you need to create flexible working groups for specific activities, and if so, does the platform selected allow you or better still help you to do this? What kind of records do you need to keep? When should data relating to such records be made available: before, during or at the end of a course? Are there administration issues to consider relating to course payments, records of time spent in training, etc.?

Some but not all platforms support these kinds of activities. Do you need to administer access rights to various parts of the course content? Is your content arranged in a linear way? In other words, do trainees need to pass through Part 'A' before doing Part 'B'? If so, you should check to see if the platforms you are investigating allow you to do this easily.

Here is a list of elements relating to organisation and administration for you to consider.

☐ Installation
☐ Authorisation: assigning access and privileges
☐ Registering (online/offline)
☐ Online fees handling
☐ Security
☐ Resource monitoring (logging)
☐ Remote access
☐ Crash recovery
☐ Capacity: number of courses
☐ Number of students
☐ Number of connections
☐ Number of instructors
☐ Environment transportable to other platform

Table 21: checklist of administration and organisation for electronic learning platforms

Standardisation

You should also bear in mind the issue of standardisation, an increasingly important issue in the development of reusable learning content.

Standardisation within the e-learning community

The provision of high-quality multimedia* learning materials is crucial to the successful utilisation of ICT* in training. However such products are expensive to produce, making reusability a key requirement. There are other requirements, such as being multilingual, compatibility, and interoperability* and it is generally agreed that open standards are essential to ensure an environment where these requirements can be met. The lack of standards for learning, education or training technologies is perceived as a major inhibitor to a large-scale deployment of these technologies, the more so because of the strong cost constraints faced by this sector. A wide range of standards is needed, ranging from those relating to the basic hardware and software combinations to those specified at the level of administrative record-keeping. Many of these will be met by general international ICT standards not specifically aimed at meeting educational and training requirements, however important technical standardisation work is taking place with a specific focus on this domain which needs to complement the more general effort.

There are a number of standardisation initiatives specifically related to the learning sector with which the reader may wish to become familiar. There are also significant global activities connected with learning technologies. These include:
CEN Comité Européen de Normalisation, Information and Communication Technologies - European Localisation Requirements looks at standardisation in the field of information technology as applied to character sets, to ensure that European requirements are satisfied. The work includes other localisation-aspects of Information and Communication Technology, such as string representations reflecting date and time conventions, currency notations and other cultural aspects of ICT in Europe.
CEN/ISSS has several workshops involved with standards related to learning technologies, such as Metadata* for Multimedia Information and e-commerce.

CENELEC has priority areas that determine the free movement of goods and services including EC or EFTA mandates for standardisation of information technology and related equipment.	globally accepted standards for a wide range of domains; a Learning Technology subcommittee, SC36 has recently been established in the ISO/IEC JTC1.
ETSI focusses on European standards for telecommunications.	W3C produces many generic and domain-specific standards and specifications for the World Wide Web and the Internet.
ICTSB was set up by CEN, CENELEC and ETSI. Its work includes ensuring that standards and specifications are prepared on time and by the right people.	GESTALT (Getting Educational Systems Talking Across Leading-edge Technologies) was a European project that has implemented extended LTSC specifications.
IEEE* LTSC has several study and work groups focussed on standards development addressing different aspects of learning technologies.	The IMS project has centres in several countries and has produced a wide range of specifications for learning technologies
ISO and IEC have produced many	

Table 22: standardisation within the e-learning community

Cost implications

When you go to choose a platform you will need to consider the following list of possible costs. In some cases the price setting will consist of a combination of some cost issues. There are considerable differences in the costs associated with different platforms and so it is well worthwhile to 'shop around'.

☐	Cost of purchase or annual fee
☐	Type of license: per seat (simultaneous users), per trainee (accounted or defined user) or campus license
☐	Cost of license(s) for course developers
☐	Cost per processor or per server
☐	Hardware cost implications
☐	Cost for maintenance
☐	Operational costs (technical, administrative support)
☐	Updating/upgrading/up-scaling
☐	Hidden costs (extra soft/hardware, licenses, etc.)

Table 23: checklist: costs of electronic learning platforms

On top of the upfront learning platform costs, you may encounter a number of additional costs that are related to the specific conditions in which you use the platform: additional database licenses, additional hardware and network infrastructure, additional software (for course designer or for learners), complementary software for reporting, evaluation, accounting, communications.

CASE STUDY

TELEFONICA, Spain [11]

[11] Case studies carried out in the framework of the transnational project TIDE (Information Technologies, Training and Employability) supported by the European Social Fund (ESF) in the Adapt-Bis programme.

The Telededactic Network (implemented with the software Global Teach 3.2) is a teletraining service for the Telefonica holding company. Its main objectives are:

- To enable trainees access self-training resources (computer-based training packages as well as other training products),
- To provide direct access to tutor-directed training plans and tutored courses,
- To provide information about Training Department activities.

Telefonica has taken a clear decision to incorporate teletraining into its general training strategy. The intention is to make training available to its staff anywhere, anytime, at the workplace as well as at home while at the same time reducing training costs.

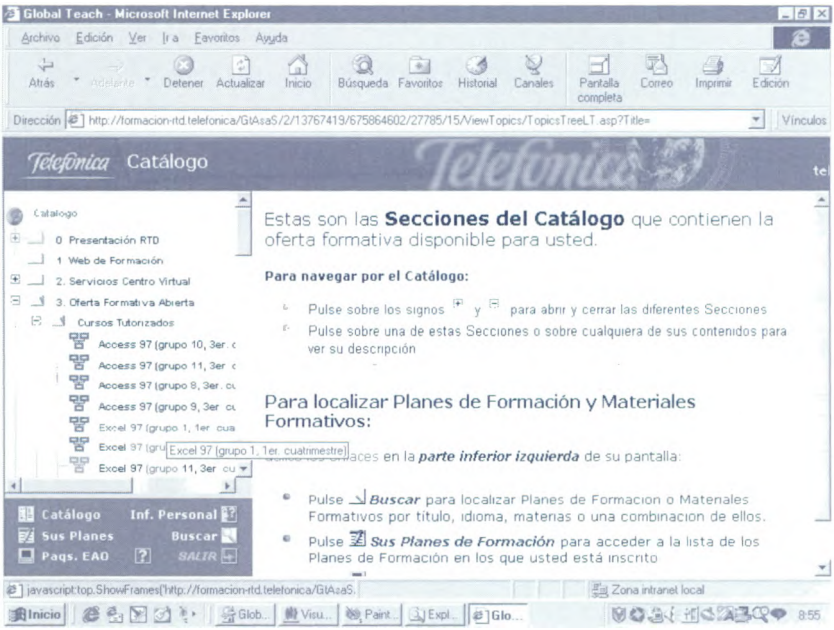
This strategy is still at an early stage of development, but the objective is clearly to make the shift from a classical corporate training model to a mixed-mode training system in which technology plays a key role, even though traditional training will still have a very important role to play in the future. The figures seem to confirm the fact that the right choice has been made. In one year alone 7,000 new users have become subscribers to the Telededactic network. When developing this learning environment, Telefonica has also taken into account the AICC* guidelines regarding standardisation of learning content and computer-mediated instruction.

The student interface

Trainee Welcome Page

On the Trainee Welcome Page the learner can select between different modes:

- Training Plan view, online (Entrar con conexión)
- Training Plan view, offline (Entrar sin conexión)
- Registration (Auto-registro)



Training Catalogue View

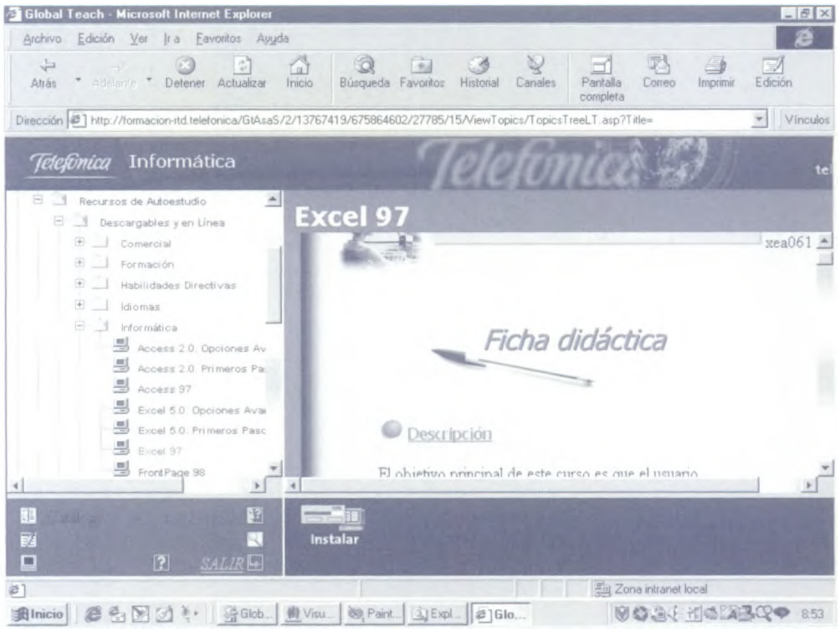
The client user interface is separated into different main functions: in the bottom left corner the trainee will always find a navigation tool, that allows him/her to switch between the different views and functions:

- The Catalogue View (Catálogo): gives an overview of all the training materials available from the Teledidactic network for each individual trainee
- My Training Plans (Sus planes): this function shows all Training Plans where the logged-on user is registered
- Help: access to the online help
- Admin (Personal): this function allows the user currently logged on to access her/his personal information (address, etc.), registrations and orders
- Logout

The training courses on offer can be explored by going into the deeper levels of the catalogue: here the trainee will find:

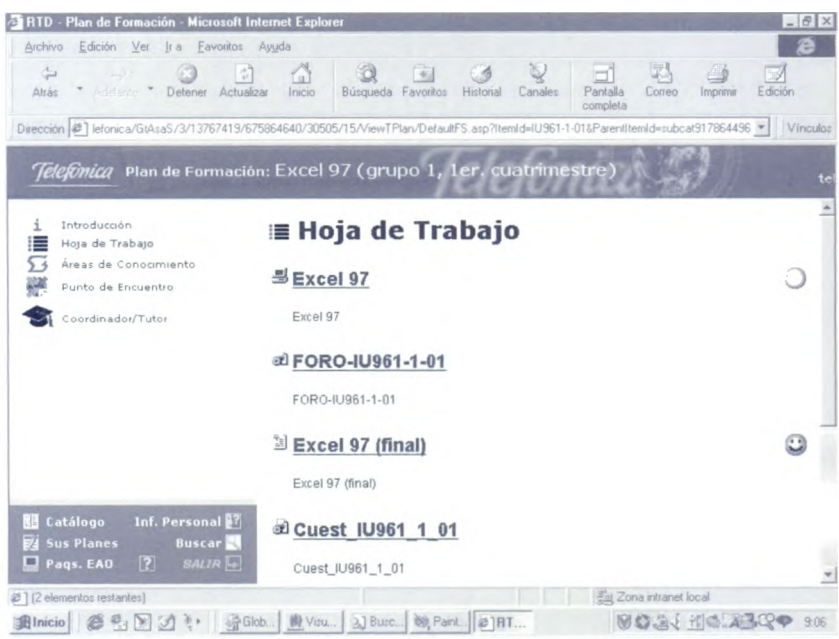
- OFA: Oferta Formativa Abierta (open training offers)
  - ↳ Recursos de autoestudio (self-study resources)
    - ↳ Descargables y en línea (downloadable files and online mode)
      - ↳ Informatics
        - ↳ Excel 97. Download (descargar) the courseware

Self-Paced Training Materials

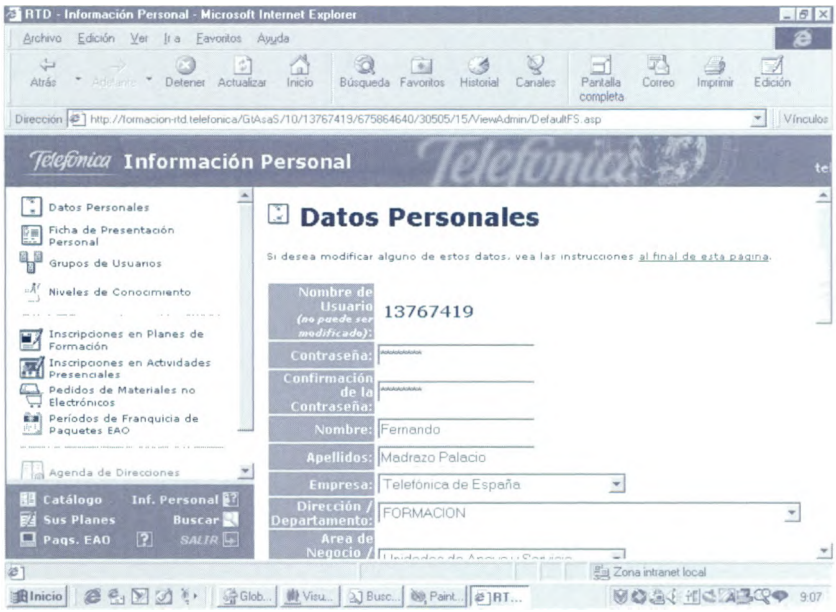


Much in the same way, the trainee can select tutor-supported training materials.

Training Programme Content



The training platform also comprises an administrative section in which the trainee receives information about his/her enrolment, the results achieved so far, and an overview of his/her personal training plans (both traditional and online). [11]



Trainee's Administration Page

Nokia Mobile Phones (NMP), Finland [12]

Nokia Mobile Phones in Finland are experienced users of Information & Communication Technologies (ICT*) for training purposes and generally use a mix of technologies to support various training initiatives. One of these was the programme organised within the framework of a continuing education application for Technology and Science Strategy experts that took place from January 1998 until January 1999.

The objective of this project was to create a framework for training in the company, which permitted flexibility for learners, teachers, line managers, and course content providers who are geographically dispersed. The learning and teaching concept needed to be applicable to almost any course contents whether it be technical, managerial, or personal skills development.

A first course on Electromagnetic Compatibility, aimed at technical managers and experts of NMP, was organised during Spring 1998. There were 33 participants from six geographically different sites of the company. The course consisted of lectures by videoconferencing* (20 hours), two two-day intensive seminars and an Internet-based learning platform for learners and tutors. There was one main professor lecturing, assisted by three course tutors. The course made use of an Internet-based learning platform built on the commercial software Lotus Learning Space (LLS). The course was organised from September 1998 to January 1999. This course was aimed at 20 leading scientists and technology managers of the company, located in different European countries as well as in the United States. The objectives of the company were to help these top scientists:

- to become leaders and tutors for junior engineers;
- to be able to analyse theses in their domain of specialisation;
- to write scientific articles in international reviews;
- to participate in international conferences.

[12] Case study quoted as part of final report of Blueprint for Interactive Classrooms (BIC) project, supported by European Commission Telematics Applications Programme. Full report available on BIC web site at: http://www.avd.kuleuven.ac.be/BIC.

It should be noted that the first objective is quite different to the other three: it is not aimed at a personal knowledge or behaviour. Not all the top scientists in the company would be interested in this kind of tutoring, and it could be predicted that some difficulties could occur during the course. From a more general point of view, the training could be seen as a way for the company to create a third way for the engineer to develop on his/her own and be promoted, beside the two usual ones: the technical one and the managerial one. Another, implicit but not outspoken objective was to help engineers living far from Finland to feel part of a group, even part of an important group in the opinion of the top management.

Between September 1998 and February 1999, three face-to-face meetings were organised with a five-week interval between the 1st and the 2nd meeting, and a nine-week interval between the 2nd and the 3rd meeting. The students were assisted by five tutors using the Lotus Learning Space platform during the intervening periods. There were seventeen participants in this course programme.

The distance-learning platform (Lotus Learning Space) consisted of the following modules:

- Schedule / Study Guide (by module, calendar and date);
- Course Room (discussion, assignments, teamwork);
- Media Centre / Learning Materials;
- Profiles of the Participants.

Advantages

Choosing to use a dedicated electronic learning platform for learning purposes has a number of distinct advantages once you choose the tool that best fits your company and your training needs as already discussed in this chapter. Most systems have as an advantage the fact that they can usually provide you quickly with a list of the various functionalities their product offers. This means that you are well on the way to making a decision based on your needs and the entire process can be carried out relatively quickly.

Once you have decided which platform to use, you should have at your disposal a tool that can support your activities in a trouble-free way. New learners can usually be added with minimum effort on your side and your entire learning platform can be located in a common virtual area, which will help to create an identity for the learning taking place. Many platforms offer sophisticated tracking systems that can help you evaluate the patterns, behaviours and achievements of learners using the system. This can be very useful, not only in delivering learning to your current group of learners but also in planning for the future.

Disadvantages

Ill-considered decisions in relation to dedicated learning platforms can have disastrous consequences. If you choose a system that turns out to be difficult to manage, you may find yourself in a situation where both learners and tutors are turned off the whole idea of using ICT for learning purposes that will inevitably have many negative long-term consequences. Systems that require a lot of technical maintenance and know-how may cause you tremendous administrative complications as your technical resource staff struggles to come to terms with the

system. Choosing a system that is beyond your budgetary means, no matter what its advantages in other ways, will make you highly unpopular with your colleagues and may have repercussions for the long-term viability of ICT-supported learning in your company.

KEY DECISION-MAKING ISSUES CHECKLIST

Now take the time to read through the following checklist. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues. In certain cases it may be useful to refer back again to the lists of criteria on previous pages.

- Is your company already using some form of collaborative groupware for various activities?
- If so, can it be adapted to provide the kinds of functionalities you require for the training process you are planning, i.e. will it allow you to do the kinds of things you need to do to support training?
- What are the capabilities of the system you are considering? In other words, what can it do for you?
- How easy is it to use?
- Does it meet your language requirements?
- Do all the participants have common hardware and software?
- Will you be adding members whose hardware and software may be different from the rest of the group and if so, can the platform handle this?
- Has it got a lot of multimedia capability or is it mainly text-based?
- What technical requirements are there?
- Have you sufficient memory capacity to meet the needs of the system you are considering?
- Do you know other companies using it? And if so how successful is it for them?
- Is your network powerful enough to support the platform that you are considering?
- What kind of technical support will participants need?
- How much will it cost to implement?
- Are you confident that the company supplying the platform has sufficient resources to meet your long-term needs with respect to maintenance and possible expansion of the system?

Chapter 6

Web-based training

Introduction

New demands in organisations are resulting in an increased interest in the way in which web-based training can be used by employees on a daily basis. The need to find less expensive ways to deliver training has also led many companies to explore this option. The convenience for users of web-based training programmes - at their own pace, at their own place - and the engaging nature of multimedia* delivery are big advantages. The centralised nature of web-based training is often less expensive and more convenient than most alternatives. With careful attention to instructional design during the development phase, web-based training can be a valuable addition to your company's training and performance support offer. The web and web technologies have already had a major impact on the way businesses communicate and it is only logical that training technologies within the company should go in the same direction.

While the previous chapter dealt with various different types of electronic learning environments many of which are embedded in the World Wide Web, in this chapter we will focus more on the use of the World Wide Web for training applications and on producing specifically for use in the World Wide Web environment.

Generic description

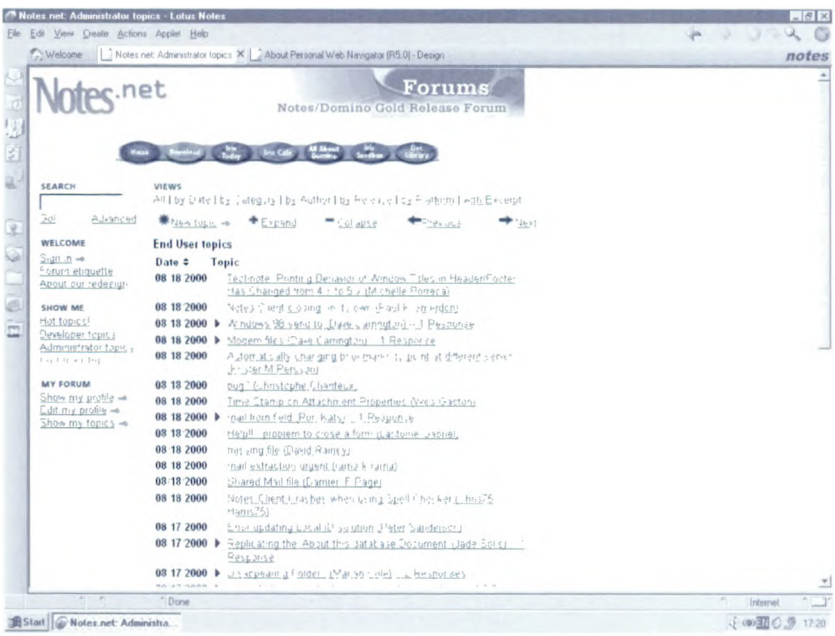
The World Wide Web (WWW) is a set of software tools and standards that allow individuals to distribute and obtain information stored on another computer somewhere on the Internet. Like e-mail* and electronic learning platforms, the WWW adds features to the Internet but relies on the Internet for data transportation and error checking. There are now millions of information files on the WWW, with many more added each day. The WWW is a decentralised information system; this means that you are free to add new information to it whenever you like. This does however raise questions about the accuracy of the information found on the WWW and can lead to problems with regard to censorship and Intellectual Property Rights (IPR*).

Web-based training can be delivered to any computer that can access the Internet or a company intranet* and that can be accessed using a standard web browser* such as Netscape Navigator or Microsoft Explorer. Other types of Internet training refers to any programme that can be delivered from a remote source, including electronic learning platforms, e-mail correspondence courses, or the transfer of files of course materials. Training over the World Wide Web, and training using an intranet's web, specifically refers to the readily available, interactive, multimedia nature of web browsers and associated plug-ins. Although electronic learning environments are migrating more and more to the web, they are basically a much broader group of learning applications that allow for specific training features that are much more tutor-to-learner interactive. Web-based training in its strict sense is much more a successor of the interactive disc-based multimedia training package.

Multimedia training

Multimedia training is a type of computer-based training that uses two or more media, including text, graphics, animation, audio (sound/music), and video. In practice multimedia uses as many of these media as is practical to produce colourful, engaging programmes delivered via the computer. A typical programme allows users to control their progress and pace through the course so everyone can learn at his or her own speed.

Table 24: multimedia training



Web-based communication platform (Lotus Notes)

Web-based training does not exclude interaction with tutors or other parties involved in the learning process. Communicating using web-based tools usually allows the following additional features:

Information can be organised and stored on a dedicated server* so people can look at it whenever it is convenient. This means you can change the way archived information is displayed (for example, by date, author, or subject). It can support multimedia features such as graphics, photographs, audio, and video. This also means that users can really interact with the content by adding or changing information through the use, for example, of web-based forms that they complete.

Similar to e-mail attachments, you can download* files from the web, but, as with e-mail attachments, you need the appropriate software to read each file.

Most web-based discussion systems and mailing list server archives incorporate some type of sort and search capabilities. The simplest of these allow sorting by subject, date, or author. More sophisticated systems allow sorting by keywords entered at the time a message is posted. Some discussion systems also allow full-text searches of all documents in a discussion. This means users can search for words or phrases in a set of messages, similar to searching a single document with a word processor.

Using the WWW as a training application

To adopt web-based training within your company you need to assess available skills and abilities as well as the training that is already currently in place within the organisation. Is the company ready to implement web-based training? Is training already part of the company culture: is it taken seriously by employees and management? Do all trainees that need training have access to a computer with a sufficient-quality access to the Internet or to your company's intranet?

Have you identified the courses that are most commonly and urgently needed? Will it be possible to adapt these courses in a suitable way to the delivery via the WWW? Will you be able to develop the web-based training package within the timing that you have?

In order to convince the company management as well as your trainees of the benefits web-based training can have, it may be worthwhile to select a pilot course that appeals specifically to a large group within your company, for example the sales force. These are usually people that do not like to take time off to travel to a central location to undergo training.

Pedagogical implications

Placing course materials on the web can have certain advantages for trainers and trainees. Trainers and training managers can start pragmatically by putting up a course syllabus and gradually expanding the postings to include announcements, reminders, links, lecture notes, assignments, practice quizzes, exams, and finally laboratories. Using web pages in this way has certain benefits such as permanent accessibility (day and night, all days of the week), speed, direct communication, action, bookmarks* to related sites, links to 'hot' topics in your subject matter, and accurate learner notes. Action may be important when there are dynamic processes or issues in your course matter. A single drawing is not as effective as an animation to illustrate how changes occur. It is worthwhile to spend some time and effort in producing better illustrations for web pages than for whiteboard lectures. Trainees who can't attend training sessions can still access the online* presentations.

Web pages can and should include interactive materials and animations. These two features add new dimensions to a course. Interactive 'lectures' enable trainees to follow a path through the lessons and presentations that can give them positive reinforcement as they study. It can also give them a choice of the 'pace' or complexity of the path that meets their needs. Web pages that include animations put a visual component into the lessons that can be more powerful than the text description or simple illustrations alone. This is especially true when trainees are accustomed to visual information. The action in an animated graphic attracts attention from the viewer. It is often more effective at depicting a dynamic process than a verbal description.

Web pages also allow trainees to have accurate notes. Accurate and up-to-date notes are often a problem for those who are just beginning and inexperienced with a specific topic. When the presentations are posted, the trainer can be sure that the trainees will receive relevant information relatively error-free. Learners that still prefer hard copies can print out the materials and study in that manner.

Criteria for evaluating web-based training

- Does the programme include the right amount and quality of content?
- Is the course designed in such a way that the learners will effectively learn (instructional design)?
- Is the course interactive and are users engaged through opportunities for their input (interactivity)?
- Can users determine their own way through the programme? Is there an exit option available? Is there a clear course map or navigation accessible? Is there an appropriate use of icons and/or clear labels so that users do not have to read excessively in order to determine programme options?
- Does the programme engage users through novelty, humour, game elements, testing, adventure, unique content, surprise elements or other motivational components?
- Does the programme appropriately and effectively employ graphics, animation, music, sound, and video? Is gratuitous use of media avoided?
- Is there some type of evaluation, such as completion of a simulation? Is mastery of each section's content required before proceeding to later sections? Are section quizzes used? Is there a final exam? Is there some mechanism for rewarding the successful participant?
- Aesthetics: is the programme attractive and appealing to eye and ear?
- Is learner performance data recorded, such as time to complete, question analyses, and final scores? Is the data forwarded to the course manager automatically?
- Is the programme designed for its audience: does it have the right tone? Does it avoid being condescending, trite, pedantic?

For the author, designing for the Internet presents some specific problems. Connection speeds can be slow and downloads can be long due to factors over which trainers often have no control. Until bandwidth* improves, it is safer not to include most bandwidth-hungry media such as video in a programme. It is a good idea to include more interactivity, discussion, and access to other resources in your design as these are part of the benefit of training online.

From a student's point of view web-based training is not very different from CD-ROM-based* training. CD-ROM-based training programmes usually have their own unique interface*. Web-based training requires a web browser, so the basic navigation scheme is usually familiar to the student. In some cases web-based training programmes are designed to replace the browser window while the course is running. In general the student should see little difference in the actual training once the programme has been accessed. If the training is delivered over a company's intranet, the difference is not very noticeable, but over the Internet, the connection speeds and download times are often much slower than CD-ROMs.

An assistant, a facilitator or a tutor available online can be helpful but the training can be designed without such support. One alternative is to provide an automated helpdesk service including a section with Frequently Asked Questions (FAQs) instead, although this will depend to a great deal on users' typical needs and requirements. A facilitator can also help handle user service issues or technical problems. A facilitator can help with content issues and can guide discussions.

Web-based training, especially when designed within an organisation, is usually designed to be a stand-alone process in which the trainee can participate at any time, day or night. Even when designed to be such a stand-alone process, having e-mail access to a webmaster, course manager, or content expert can be helpful.

Technical implications

Hardware* and software* requirements for the end-user should be realistic: what is usually required is first of all a computer fast enough to handle the programme itself. Windows PCs with 486 processors can still be used for most web-based learning applications but Pentium or better is preferred. For Macintosh PowerPC is preferred. When the programme has audio elements, the computer also needs a sound card capable of playing back any audio files used by the programme. Lastly a network connection is required, whether it is a digital* line connected to the company server (e.g. an Ethernet* connection), or a modem* that can dial into the Internet. If your training is being delivered via the company's intranet, your users will not need a separate Internet connection. Software required by the end-user includes a web browser, plus any specialised browser plug-ins that are required by the particular training programme, such as appropriate audio and video players.

The end-user does not need the same computer system as the developer. One of the major advantages of web-based training over other types of computer-based training is cross-platform compatibility. Web browsers can access web-based training using a language that is platform-independent.

The team you need to implement and develop web-based training can range from just one enthusiastic and very dedicated person who does it all, to project teams of over 40 professionals.

However as a general rule you will need:

- A project manager/production manager capable of dealing with diverse work styles and personalities: understanding the different stages of the project and the different skills involved in developing the programme. He/she will also manage the budget and time schedule.
- An instructional designer familiar with computer-delivered instruction.
- A programmer or author to use the authoring tool. The web-based training programmer does not necessarily need to know special programming languages to create programmes for the web. In general HTML (HyperText* Markup Language, the authoring language used to create documents on the World Wide Web) or one of the high-level HTML editors (such as Adobe GoLive, Macromedia Dreamweaver, Allaire HomeSite or Microsoft FrontPage) will be enough. Major authoring programmes (such as Authorware and ToolBook II) are nearly the same whether you are developing for CD-ROM or for the web and allow you to output in either programme format.
- One or more graphic artists.
- One or more subject matter experts.
- A webmaster for maintaining the programme on the server.

People in your team may of course have either one or a combination of the above skills.

Cost implications

Web-based training usually requires more time and money to develop than people expect. Like any first-time challenge, learning about and implementing new technology requires considerable resources. However this is still a medium in which it is worth investing, one of the most important reasons being that more and more information services and programmes within companies are moving to the World Wide Web. The web can provide probably the most efficient delivery of information because of its ability to be accessible from anywhere, anytime, and to disseminate a standardised yet updateable version to multiple users.

Decision-makers can be wary of new technology, but significant cost savings do attract their attention. Lower training costs result from the reduction in time and resources for delivery, especially through eliminating the cost of travelling to distant learning sites when web-based training is contrasted with face-to-face training. The biggest hurdle in convincing decision-makers of its value is often the level of investment required to both understand the technology and to develop products. It can be made easier by starting with one or a limited number of simple programmes and building on success. Companies working in this way soon find out that costs associated with web-based delivery of training are much lower than for traditional methods.

Case study

Encyclomedia, Belgium [13]

The Encyclomedia web site is the logical successor of the original print-based and later CD-ROM-based resource on Multimedia and ICT* produced by Prof. D. De Grooff from K.U.Leuven. In order to continuously update the content of the original concept and to make the material more effective for training and learning purposes it was decided to opt for a web-based approach.

[13] From the website: http://www.encyclomedia.be/.

The web site is directed at university students and at corporate trainees who want to learn the basics of ICT and multimedia. The access to the web site is therefore password-secured in order to restrict the use to its target audience. On the entry page, the user finds the basic functions such as: search within the site, navigation tools that help him/her to find his/her way through the content, a news update where added or updated topics are presented, and a form that allows feedback or communication with the publisher.

Other parts of the web site offer more extensive communications (Postbox), the Message Board, announcements of Workshops, a Kiosk, Tasks and a more elaborate Search Page where additional search engines* (enabling searches outside this site as well as searching for books with online bookshops) are presented. The Message Board is a threaded mail repository where reactions and questions are published from users together with the feedback from the teacher or tutors. The messages are organised by question or topic. The Workshop part of the site announces the agenda for the online discussions and their topics, organises the outcomes of these virtual discussions in Frequently Asked Questions lists and gives the user another way to ask questions. The Kiosk links directly to a large number of online publications and magazines that may be of interest to the user. The Tasks page gives the user clear and concise instructions for self-activity that will be assessed by the tutor.

The largest part of the site is the resource base that describes the different technologies and applications of multimedia and ICT, ranging from graphical

techniques (print) to Virtual Reality*. The topics are arranged in chapters with a clear indication of the learning objectives, text materials supported with images that can be read online or that can be downloaded for offline* use, links to web sites with additional information and lastly a self-assessment module that gives the learner a good idea of his/her understanding of the content.

WIPO Academy: World Intellectual Property Organization, Switzerland [14]

[14] As described at an international conference on Online Learning in 1999. Book of Abstracts - Online Educa Berlin 1999.

The World Intellectual Property Organization (WIPO) is a specialised agency of the United Nations, established in 1967 with the mandate of promoting the protection of intellectual property throughout the world through international cooperation among States. It was precisely for the purpose of teaching and advancing knowledge in the substantive areas of intellectual property that the WIPO Academy was created in March 1998. The Academy organises and administers a series of programmes devoted to the development of human resources, teaching, training and research in the field of intellectual property. The Academy's Distance Learning Programme has been developed to respond to the need of reaching out to an expanded, worldwide audience of current and potential users of intellectual property rights. Introduction to Intellectual Property (IP) is the first online-delivered course developed by the Academy. Launched in June 1999 as a pilot in English, it is now offered in English, French and Spanish three times a year in each language. Its duration is estimated to be about 40 hours of study time, over a period of six weeks. The course is open to up to 200 participants per language, per session.

The objectives of the course are to raise awareness of the principal concepts of IP; explain what constitutes protection of IP; introduce the treaties that govern IP, and explain the services of WIPO that assist the worldwide acquisition, management and protection of IP rights.

The course is targetted to anyone interested in acquiring an introductory knowledge on intellectual property. It is particularly suited to government officials recently transferred to IP-type activities; staff in collective management of rights organisations; law students in countries where IP is not taught as part of the curriculum; technical students needing a basic knowledge of IP; business managers in publishing, broadcasting and industry.

The course web site has been developed to present a clean, sober look, in accordance with the instructional nature of the content. The web site pages consist of low-resolution* graphics and texts created and optimised for delivery at 14.4 kbps*. In order to be able to participate in the course, students require an Internet-connected computer, with a minimum of 28.8 kbps connectivity, sound card and MS Internet Explorer 5 or Netscape 4.05.

From a pedagogical point of view, the structure of the course reveals some interesting features. It is a six-part course that covers copyright, related rights, patents, trademarks, geographical indications, and international registration systems. These substantive modules are complemented with a study guide, general introduction to intellectual property, an essay on the economic value of Intellectual Property Rights, and a glossary. This modular structure allows the students to 'play' with the interface. Here, the learning process is not linear anymore; overviews, in-depth analysis, reinforcements and summaries, are developed in parallel.

As a complement to written text, the course contains a series of audio files, where IP experts discuss different issues in more detail than in previous text explanations.

The use of audio segments allows the designer to diversify the learning experience, adding the sound of the instructor's voice to the written text. In this way the 'distance' between student and instructor is shortened, allowing good levels of personalisation of the study materials.

A system of tutorial assistance has been developed to support the participants during their studies. Tutors are not located in WIPO's buildings, but like the students themselves, they are based in different locations around the world. They are IP experts, specially trained to deal with this new means of delivery. At the moment, a ratio of 25 students per tutor has been adopted as optimal. The contact between students and tutors is based on e-mail communications.

Online conference facilities have also been provided in order to facilitate the transmission of audio, video and text over the Internet. These conferences are available 24 hours a day, 7 days a week, and facilitate a new style of information-sharing known as collaboration, which in essence allows the sharing of multiple levels of information between the students themselves, and/or students and tutors.

As currently designed, the course contains two main test mechanisms: several end-of-module tests, and a final exam. For the end-of-module tests, students have to choose the correct answers from a series of statements (multiple-choice), while in the final exam students have to develop detailed answers on the subject matter contained in each of the modules. Multiple-choice questions are automatically marked, so that students immediately know their score on the test. The open-ended nature of the final test requires more elaborated answers and the involvement of the tutors. After successfully completing the final exam, students are eligible to obtain a WIPO Academy certificate.

Self-Assessment Questions (SAQs) are another relevant pedagogical tool. As clearly explained in the Guide to studying the course: 'just thinking the answer through does not serve the same function (as writing them) and is less effective in helping you remember the material'. SAQs are not sent to the tutors, but are archived in the student's 'personal status' file, for future reference.

To facilitate the management of the Academy's WWW courses, a sophisticated Management Information System (MIS) has been developed. This MIS is purely web-based, and allows tutors and course administrators real-time management, independent of their physical location. The MIS encompasses all the information gathered during registration, delivery and evaluation. The tutors/administrators can review the students' progress, including examination results, study time per module, dates and times of access, etc. At the end of their studies, students participating in the course are required to fill in an online evaluation questionnaire, which will enable the Academy to refine and improve the course content and delivery.

RHODIA Melle, France [15]

RHODIA Melle is a chemical factory specialised in biochemistry and organic synthetics, part of the RHODIA Group in France. On the site in Melle, there are about 400 employees. In 1999, the management decided to create an intranet as a tool to provide access to information as well as training for all employees: young starters and older, experienced employees. With the help of the intranet, the management also hopes to reinforce a positive external image.

[15] Case studies carried out in the framework of the international TIDE project. (Information Technologies Training and Employability) supported by the European Social Fund (ESF) in the Adapt-Bis programme.

The specific target audience is defined as follows:

- Young starters, to familiarise them with the factory, the security regulations and the personnel.
- Personnel in training can use training software, made available through the intranet, not only to prepare for traditional training sessions, but also to update acquired knowledge and skills. In the longer term, it is envisaged that the intranet will allow the customisation of training for individuals as well as being an important means of relieving the pressure on traditional training sessions.
- Management staff will be able to access essential data about products, security and safety to support their management and training responsibilities.
- Older employees (45 years and older) will have direct access to continuously updated information at all times, which will help them solve problems they may encounter on the work floor.

The pilot group that was initially involved in the set-up of the intranet (one responsible for Informatics and one responsible for Communications) acted as the animators of the project and soon extended into a working group that was supplemented with representatives from the different services on the factory site, selected by each service's management on the basis of their dynamic attitude, availability, and their technical and functional complementarity. In this way, the working project group made sure to involve the direction and ensured the motivation of the staff involved, and the aptness/purposefulness of the project.

During the project team meetings, 4 major themes were addressed:

- The content of the intranet
  - Training
  - Information and communication
  - Skills, knowledge and procedures
- The style and concept of the intranet
- The search for the right external company to support the project technically
- The marketing of the intranet to its users

The importance of the intranet for training purposes is easily understood: the employees of the factory need to keep their skills and knowledge up to date in order for the factory to stay competitive. It is impossible however to invest in large and costly training sessions, mainly because of financial reasons. It was hoped that the introduction of an intranet would enable the delivery of more focussed and light-weight training, that would allow trainees less time away from their workplace. It was also very difficult for the training department of the factory of Melle to find good training materials on the market that were of any use to their employees, because the standard training materials often lack suitability to specific factory situations. The intranet however was designed in such a way that it would be able to carry the training programmes developed in-house or acquired externally, thus allowing for the innovative integration of all training materials. Typical training materials made available from the beginning were basics in maths, French, English, chemistry, physics, economics, etc. But there were also more specialised training

focussed on different technologies like distillation, process control, etc. Furthermore typical ICT courses such as use of spreadsheets or word processing were offered.

All members of the working group, assisted by an external support company, are constructing the intranet site collaboratively. The tool in use is common web design software that has proven to be easily learnt. No special skills needed to be acquired for the design.

A successful launch of the intranet was only possible through a major reorganisation of the computer infrastructure at the factory and by the involvement of the ICT department of the company. Thanks to a careful redistribution of PCs, all employees now have easy access to the intranet. Additional multimedia PCs were installed at strategic locations. The ICT team of Melle facilitated the launch of the intranet to a great extent. Their technical support was essential during the design, installation and operation. Their continuous presence on the site allows the necessary degree of maintenance and service.

Resources spent on the development of the intranet run as high as 125,000 EURO. The labour is estimated to be about 232 person days.

[16] Brandon Hall, 1995, 'Return on Investment and Multimedia Training' in Multimedia and Internet Training Newsletter.

Advantages

Web-based training has many advantages. Courses are available via intranets* or via the Internet and can easily be accessed with a browser and without additional software. The technology is cross-platform. Unlike other forms of computer-based training, all users (Windows, Mac or UNIX*) can access web-based training without requiring additional software. The training programme is authored once and can then be delivered to any machine over the Internet or over the company's intranet. Internet connections and browsers are widely available. Most computer users have access to a browser such as Netscape Navigator or Microsoft Explorer, and are connected to a company's intranet or have access to the Internet. Web-based training allows for flexibility, accessibility and convenience. Users can proceed through a training programme at their own pace and in their own place. They can also access training at the time of need, and only as much as they need, known as 'just-in-time' and 'just-enough.'

Additional advantages are cost and time savings: because the Internet can be accessed from any location anywhere in the world, there are no travel costs for bringing remote employees to a centralised location. This way, costs for worldwide distribution are greatly reduced; and as research has indicated [16], in some cases the actual time required for training by computer averages about 50% of instructor-led training, thus leading to significant additional cost savings.

Finally, if changes need to be made after the initial implementation, they can be made on the server that stores the programme and everyone worldwide can access the update. Courses can be designed to access designated current information, such as the latest new product information, from any server worldwide.

Disadvantages

There are some disadvantages to web-based training as well. Bandwidth on the Internet is still limited and that means slower performance for sound, video and even extensive graphics or applications. These restrictions can cause long waits for

download and can adversely affect the learning process. The problem can be serious over the public Internet where frequent traffic jams occur, but is less severe on a company's intranet, which usually has greater bandwidth and fewer concurrent users.

Today's web-based training programmes are sometimes too static. As an emerging technology, the level of interactivity in web-based training is often quite limited. This is gradually improving, and, as it does, the impact of the training on performance improves.

Are computers replacing human contact? There is general concern that as we are moving forward towards more computer use, a computer terminal replaces the friendly face of the trainer. Decreasing instructor-led training makes some trainees uneasy. Not all courses should be delivered by computer. Some training topics are not best served by computer-based training. Some courses will benefit from a mix of delivery technologies (even instructor-led and classroom-based) and may require a more personal touch. A good example is training programmes with integrated team-building activities. Web-based training also requires learners to be fairly self-directed or highly motivated to complete this type of courses.

KEY DECISION-MAKING ISSUES CHECKLIST

Now take the time to read through the following checklist to see if web-based training is right for your organisation. If you are having trouble understanding any of the questions asked, you should refer back to the contents of the chapter and/or the glossary of terms at the end of this handbook. If you do not yet know the answer to these questions, then you probably need to consult with one or other of your colleagues.

- Will management support the effort?
- Can the subject matter be effectively communicated using the WWW?
- Does the media provide a safe atmosphere conducive to learning?
- Are there enough potential users to justify the cost of purchase and development?
- Does the target audience use (or can they be taught to use) a computer, the Internet, the WWW?
- Will users accept a web-based training programme?
- Will users learn from the programme that you intend to develop?
- Does the programme provide a method of instruction that is easier, faster, cheaper, safer, or more engaging than the alternative?

Resource, reading and reference list

Resources list

Media selection and using Information and Communication Technologies (ICT) in training

The following list of web sites will give you some more general information on how to select, adapt and use media for training purposes.

http://www.ingenia-training.com/ingenia

http://teleeducation.nb.ca/lotw/c7.html

http://www.outreach.psu.edu/de/id&D/media_selection_matrix.html

http://www.intercom.es/cetemmsa/odl/main.htm

http://www.allencomm.com/software/advisor/

http://www.fae.plym.ac.uk/tele/tele.html

http://www.cudenver.edu/public/education/edschool/papers.html

http://www.icbl.hw.ac.uk/cause

http://www.icbl.hw.ac.uk/ltdi/briteideas

http://www.cti.ac.uk/starters.html

http://www.tft.co.uk/

http://vmf.sjakk.fi/vmf/

http://www.wlv.ac.uk/celt/oltips/

http://lorien.ncl.ac.uk/ming/Resources/cal/CAL.htm

http://www.gwu.edu/~tip

http://ww4.choice.net/~prosys/de.htm

http://www.cudenver.edu/~mryder/itc_data/idmodels.html

http://www.idb.hist.no/fag/X-PedagogyInOpenLearning-EU/lessons/11/design-ict.htm

Videoconferencing and telepresence

This list will provide you with further background on the use of videoconferencing and other telepresence applications.

http://www.avd.kuleuven.ac.be/BIC

http://www.savie.com

http://www.kn.pacbell.com/wired/vidconf/

http://www.man.ac.uk/MVC/SIMA/video3/contents.html

http://pentalfa.med.kuleuven.ac.be/

http://www.ivpv.ftw.rug.ac.be/infotec/

http://www.imec.be/seminars/itc/

Electronic learning platforms

This list relates specifically to Electronic Learning Platforms. Many of the sites listed will provide you with an overview of different platforms in order to make your own selection.

http://projects.europace.be/tide/studie1/schema.html

http://www.infoworld.com/cgi-bin/displayTC.pl?/981123comp.htm

http://www.inform.umd.edu/TeachTech/itech.html

http://www.oc.utwente.nl/w3ls/english/index.htm

http://demo.cstudies.ubc.ca/integrated.html

http://www.ctt.bc.ca/landonline/choices.html

http://www.jtap.ac.uk/reports/htm/jtap-041.html

http://websites.ic.uva.nl/ictow/vergelijking.htm

http://www.education.gouv.fr/rapport/bancel/default.htm

http://www.zdnet.com/eweek/stories/general/0,11011,2391276,00.html

http://www.educnet.education.fr/actu/rapports.htm

http://www.teleleerplatforms.nl/

http://www.esocrates.com/LearningResources/ComparisonChart.htm

Web-based learning

This list relates specifically to web-based learning.

http://info.med.yale.edu/caim/manual/contents.html

http://teleeducation.nb.ca/lotw/index2.html

http://www.confederationc.on.ca/courses/node/Default.htm

Standardisation and Intellectual Property Rights (IPR)

There are a number of important initiatives in the field of e-learning standardisation and IPR issues:

http://imsproject.org/

http://www.cenorm.be/isss/workshop/lt/

http://www.aicc.org/

http://www.ieee.org

http//www.wipo.org

Organisations and networks

The following sites provide links to some of the organisations and networks active in the field of ICT-supported learning and training generally.

http://www.europace.be

http://www.trainingvillage.gr/etv/elearning/default.asp

http://prometeus.org

http://www.proacte.com

http://www.educause.edu/

http://www.etf.eu.int/

http://www.future.sri.com/LOD/

http://ifets.ieee.org/

http://www.eto.org.uk/eito/

http://www.learndirect.co.uk

http://gem.jrc.it/default/

http://www.lti-portal.org/

Terminology

http://www.cet.hut.fi/glossary.html

http://www.tft.co.uk/glossary.html

http://www.caliber-net.odl.org/htdocs/outcomes/glossary/indexE.html

http://cwis.kub.nl/~dbi/instruct/www/12.htm

http://www.encyclomedia.be/

http://whatis.com

Further reading

The following list of books will serve to provide the reader with further information about various topics.

Assessing Cost-Effectiveness for Virtual Learning and Instruction: Why and How? by Christel Claeys in C. Feyten & J. Nutta (Eds.), *Virtual Instruction: Issues and Insights from an International Perspective.* Englewood, CO: Libraries Unlimited, 1999.

Being Digital by Nicholas Negroponte. Hodder and Stoughton, UK, 1995.

Bridging Companies and Universities for Postgraduate Training: Two Large-Scale Case-Studies by Marc Ketels, Proc. SEFI Annual Conference, Sept. 1998, Helsinki (Finland), pp. 165-168.

Building Learning Communities in Cyberspace: Effective Strategies for the Online Classroom (The Jossey-Bass Higher and Adult Education Series) by Rena M. Palloff, Keith Pratt. Jossey-Bass Publishers, 1999.

Classrooms for Distance Teaching & Learning: A Blueprint. Editors: Michael Hegarty, Anne Phelan and Lisa Kilbride. Leuven University Press, 1998.

Delivering Digitally by Alistair Inglis, Peter Ling, Vera Joosten. Kogan Page, 1999.

Distance Education, a Systems view by Michael Moore and Greg Kearsley. Wadsworth, California, 1996.

E-moderating: the key to teaching and learning online by Gilly Salmon. Kogan Page, 2000

Implementing Computer Supported Cooperative Learning by David O'Connell. Kogan Page, 2000.

In Search of the Virtual Class; Education in an Information Society by John Tiffin and Lalita Rajasingham. Routledge, 1995

Instructional Effectiveness of Video Media by C. Douglas Wetzel, Paul H. Radtke, Hervey W. Stern, H.F. O'Neill. Lawrence Erlbaum Associates, Hillsdale, NJ, 1994.

Interactive Distance Learning Exercises that really work! Turn Classroom Exercises into Effective and Enjoyable Distance Learning Activities by Karen Mantyla. American Society for Training and Development, 2000.

Internet-Based Learning edited by Deanie French, Charles Hale, Charles Johnson and Gerard Farr. Kogan Page, 2000.

Learning about Videoconferencing by Han Fraeters in collaboration with Sally Reynolds & Mathy Vanbuel. Leuven University Press, 1997.

Learning and Teaching in Distance Education by Otto Peters. Kogan Page, 1998.

Lifelong Learning on the Information Highway Series Ed. Roberts J. M. Judy Roberts & Associates/Associés Inc. Canada.

Literatuurstudie over de gebruiksmogelijkheden van videoconferentie als nieuw didactisch medium: Kritische succesfactoren/Randvoorwaarden/Problemen en Valkuilen, by Christel Claeys in *Virtuele Nederlandse Universiteit: Verrijking van het onderwijsaanbod door telematica-netwerking binnen het Nederlands taalgebied.* Onderzoeksrapport LINOV, K.U.Leuven, 223 pp. 1999.

Making Materials-based Learning Work by Derek Rowntree. Kogan Page, 1997

New technologies for learning: contribution of ICT to innovation in education by Roger Dillemans, Joost Lowyck, Georges Van der Perre, Christel Claeys and Jan Elen. Leuven University Press, 1998.

Online Education: Learning and Teaching in Cyberspace by Greg Kearsley. Wadsworth Co., 1999.

Open and Distance Learning by Stephen Brown. Kogan Page, 1999.

Organizational Learning by Chris Argyris and Donald Schon. Addison Wesley Longman Publishing Co, 1995.

Personal Videoconferencing by Evan Rosen. Manning 1996

Technology, Open Learning and Distance Education (Routledge Studies in Distance Education) by A.W.Tony Bates. Routledge, 1995.

The 2000 ASTD Distance Learning Yearbook by Karen Mantyla (Editor). McGraw-Hill, 2000.

The Convergence of Distance and Conventional Education: Patterns of Flexibility for the Individual Learner (Routledge Studies in Distance Education) Editors Alan Tait and Roger Mills, Open University. Routledge, 1999.

The Costs and Economics of Open Learning by Greville Rumble. Kogan Page, London, 1997.

The Knowledge Web by Marc Eisenstadt and Tom Vincent. Kogan Page, 2000.

The McGraw-Hill Handbook of Distance Learning: A 'How to Get Started Guide' for Trainers and Human Resources Professionals by Alan G. Chute, Burton Hancock, Melody Thompson, Alan Chute. McGraw-Hill, 1998.

The Media Equation; How people treat Computers, Television and New media like real People and Places by Byron Reeves and Clifford Nass. Cambridge University Press, 1996.

The Virtual University, The Internet and Resource-Based Learning by Steve Ryan, Bernard Scott, Howard Freeman and Daxa Patel. Kogan Page, 2000.

User-Friendly Handbook for Mixed Method Evaluations edited by Joy Frechling, and Laure Sharp. National Science Foundation, US, 1997.

VSAT Networks by G. Maral, Ecole Nationale Supérieure des Télécommunications (Telecom Paris). John Wiley & Sons, 1995.

Web-Based Training Cookbook by Brandon Hall. John Wiley, 1997.

Glossary

ADSL

Asymmetrical Digital Subscriber Line is a new method telephone network operators use to allow data to be sent at high speed over existing PSTN copper twisted-pair telephone wires. ADSL is capable of providing: a high-speed, uni-directional data channel at up to 8 Mbps (enough for compressed full-motion, full-colour movies) or a bi-directional duplex data channel with transmission speeds up to 5.76 Mbps.

AICC

The Aviation Industry CBT (Computer-Based Training) Committee is an international association of technology-based training professionals. The AICC develops guidelines for aviation industry in the development, delivery, and evaluation of CBT and related training technologies.

Analogue

Information represented by a measurable physical quantity with continuous values, as opposed to information in digital form.

Application sharing

A way for two or more people to work cooperatively while in different locations: all group members can simultaneously view and edit the same file over a computer network.

ASCII

The abbreviation for the American Standards Committee for Information Interchange. This is a standard that assigns an eight-bit code for every keyboard symbol to make universal transmission possible.

Asynchronous

Not at the same time. In telecommunication context: when the timing and sequencing of data transmission varies and is determined by the sending computer, as opposed to synchronous transmission.

Audio bridge

Equipment that mixes multiple audio inputs, e.g. telephone calls, from several locations and sends back to each location the composite audio of the other sources.

Audio graphics

A teleconference system, which transmits voice and graphics, but not motion video.

Authoring packages

Authoring packages are software bundles that allow you to create and deliver online courses. Ideally they include tools for the analysis, design, development, evaluation and distribution of the learning content.

Bandwidth

The width of the part of the frequency spectrum (Hz) used for transmission; determines the rate at which information can be transmitted across a medium, measured in bits per second (bps), or kilobits per second (kbps).

Bit

Short for binary digit, the smallest element of information in a binary system, abbreviated b. Its value can be either 1 or 0. Multiples kb, Mb, Gb, etc.

Bookmark

In ICT-supported learning terms a bookmark is an entry in a personal list of favourite or important World Wide Web sites.

bps

Bits per second, a unit of data transmission speed, notice lower-case b. Multiples kbps, Mbps, Gbps, etc.

Bridge
A device that interconnects several telecommunication channels.

Broadband
A high-bandwidth (high-capacity) communications path.

Browser
A programme that requests electronic documents, WWW pages, from a server and displays them.

Byte
A unit of binary data, usually 8 bits, abbreviated B. Multiples kB, MB, GB, etc.

Cable network
Cable networks, also called Cable TV or CaTV, are communication networks that typically deliver television services to commercial and domestic users via co-axial or optical fibre cabling.

CCITT
Abbreviation for International Telegraph and Telephone Consultative Committee, a telecommunications standards organisation, now called ITU-T.

CD-I
Compact Disc-Interactive is a proprietary CD-ROM technology developed by Philips in 1992 and originally aimed at the home entertainment market.

CD-R
Compact Disc-Recordable is a form of CD-ROM that allows digital data to be written directly onto a CD from a personal computer. CD-R discs can store up to 640 MB of data and can be written to using a device called a CD writer, from a standard PC.

CD-ROM
Compact Disc-Read-Only Memory is a type of optical disc capable of storing large amounts of data, most commonly 640 MB (megabytes) although up to 1 GB (gigabytes) is also possible.

Chat
A network-based software programme that allows multiple users to interact through text-based conversations in real time or synchronously.

Client
A computer or programme that has access to services provided by a server over a computer network.

Client/server
A client/server network is a network where different computers (called clients) access a single server for certain functions.

Co-axial cable
Cable for the transfer of high-frequency signals such as TV and radio.

Codec
hort for coder-decoder, hardware that codes and decodes signals. In videoconferencing, the codec converts the outgoing analogue signals to digital signals and compresses the result before transmission, and decompresses the incoming signals and converts them back to analogue form.

Compressed video
Video signals compressed in order to reduce the bandwidth needed for transmission. Some information is sacrificed in the process, which may result in lower quality.

Compression

Reducing the amount of data units required to represent information, necessary especially when transmitting video. Decompression reverses the result of compression.

Desktop videoconferencing

Videoconferencing on a personal computer usually used for point-to-point use with single users at either end.

DHTML

Dynamic HTML is a combination of standard HTML and scripts and stylesheets that allow the animated and/or interactive display of web page contents.

Dial-up connection

Dial-up access means connecting a device to a network via a modem and the public telephone network. Dial-up access is like a phone connection between computers rather than between people.

Digital

Information represented as discrete numeric values, e.g. in binary format, as opposed to information in continuous or analogue form.

Distribution list

A software programme running on an e-mail server that maintains a list of the e-mail addresses of all those who subscribe to the list. When one of the list members posts a message to the list it is automatically redistributed to all list members.

Domain name

A name that identifies one or more IP addresses (computers connected to the Internet). Domain names are used in web addresses to identify particular web pages. For example, in the web address http://www.europace.be, the domain name is europace.be.

Download

Copying data to your computer from another computer over a computer network, the opposite of uploading.

DVD

Digital Versatile Disc is a new type of CD-ROM that holds a minimum data capacity of 2.66 GB (gigabytes), enough for a full-length movie.

DVD-RAM

Machine-read/writeable DVD. This means that it can be used in a similar manner to conventional hard discs.

DVD-R

DVD-Recordable is machine-recordable and is expected to provide a large-capacity replacement for CD-R.

DVD-ROM

Designed to support computer-mediated applications and is expected to replace CD-ROM as a low-cost mass storage medium. DVD-ROM player devices will be able to read existing CD-ROM standard formats.

DVD-Video

The designated name for the DVD format that will be used to store feature-length film. A DVD-Video player will need to be used in conjunction with a standard television set, in order to view DVD-Video productions.

E-mail

Short for electronic mail, a system for writing, sending, receiving and archiving messages in electronic form, using computers and computer networks. E-mail is directed to a specific individual or a group of people.

Encryption
The electronic term for scrambling. It is used to make the contents of a particular communication unreadable to all except those who possess the key to decipher the contents.

Ethernet
The most common type of Local Area Network or LAN.

First Class
FirstClass Intranet Server Gold from Centrinity is a communications, collaborations and calendaring software tool that is easy to administer and that combines e-mail with real-time online text-based discussion and web building.

FTP
Abbreviation for File Transfer Protocol, an Internet protocol in the TCP/IP suite that specifies the transfer of files from one computer to another over a computer network; also the generic name of the software application that is used for File Transfer.

GIF
Abbreviation for Graphics Interchange Format, a standardised format for representing graphics files.

Groupware
Software that allows you to communicate and collaborate electronically is called groupware. Groupware allows people who work on different computers and/or in different places to have access to the same information, exchange information and contribute to it. This can be as simple as two people communicating directly via e-mail, or can involve a much larger group of people participating in a discussion group or using a mailing list server.

Hardware
The physical parts, components and machinery used in information technology, as opposed to the programmes i.e. software.

Homepage
The top-level document that users first see when visiting a location on the Internet. It usually contains links to additional pages that further define and explain the content and services available at the site.

Host
A computer system that is accessed by a user working at a remote location. Typically, the term is used when two computers are connected via a telecommunications network where one computer contains the data (the host), while the other computer has remote access to this data.

HTML
(HyperText Markup Language) A convention of codes used to define the structure and appearance of a WWW document, so that it can be displayed with a browser.

HTTP
(HyperText Transfer Protocol) A protocol in the TCP/IP suite that specifies the transfer of WWW documents over a computer network.

Hypertext
Written information in a non-linear structure with links that the reader can follow to different parts or pages.

ICT
Information and Communication Technologies. The combination of telecommunications, television and computing with informatics.

IEEE

The Institute of Electrical and Electronics Engineers promotes the engineering process of creating, developing, integrating, sharing, and applying knowledge about electrical and information technologies and sciences. It is a key player in the field of training and education for engineers and in that respect plays an active role in standardisation initiatives.

IMAP

(Internet Message Access Protocol) A protocol for retrieving e-mail messages that allows you to search through your e-mail messages for keywords while the messages are still on the mail server. You can also selectively download messages to your computer.

Interface

Something between the technology and the user and another piece of technology, which enables access to that technology.

Internet

Spelled with a lower-case i: any connected distinct computer network. Spelled with a capital I: the largest international network of computer networks, functioning through the use of common standards, the protocols in the TCP/IP suite.

Interoperability

The ability of two or more systems (devices, databases, networks or technologies) to interact with one another in accordance with a prescribed method.

Intranet

A network that is contained within an organisation with the main purpose of sharing information and computing resources among members of the organisation. Usually intranets use Internet technology and are connected to the Internet through a firewall.

IP Address

Abbreviation for Internet Protocol Address, the addressing system used in the Internet, assigning all connected devices a unique identification number.

IP Multicast

While in broadcasting messages get sent to everyone connected to a network, and in point-to-point connections communication takes place between a single pair of hosts, multicasting refers to the technology by which electronic messages, data or media are sent to a certain group of users. Multicasting over the Internet includes specific network protocols such as Mbone and IP Multicast.

IPR

Intellectual Property Rights: the rights authors and publishers have over works of any kind (literature, music, but also software, etc.) that they have created and published.

ISDN

Integrated Services Digital Network, a telecommunications technology for digital transmission of different types of information. One ISDN line consists of two channels of 64 kbps, which can be used separately or in combination.

ISP

Internet Service Provider, a company or institution that provides Internet connections to end-users. An ISP provides an e-mail address, connectivity software and a location that customers can connect to, thus gaining access to the Internet.

ITU-T

Abbreviation for International Telecommunications Union - Telecommunication Sector, a telecommunications standards organisation, previously called CCITT.

Java

A computer language created by Sun Computers that is designed to be loaded and run automatically through WWW browsers.

JPEG

Abbreviation for Joint Photographic Experts' Group, an ISO committee and also their standard for representing graphics files.

LAN

Local Area Network: a communications network that interconnects computers and other devices within a relatively small area.

Mail list

A list of e-mail addresses for people that have expressed an interest in a particular subject. A message sent by any one of them, is sent to everyone else on the list and arrives in his/her mailbox. Subscribers to the list can actively participate in exchanges or simply eavesdrop or lurk.

Mbone

An IP multicast-based routing protocol that allows distributed applications to achieve real-time communication over the Internet.

MCU

Abbreviation for Multipoint Control Unit, a device that bridges together multiple inputs so that multiple parties can participate in a videoconference. Also known as video bridge or multimedia communication server.

Metadata

Simply information about an electronic object, a sophisticated metadata set can encompass a wide variety of information. Most current electronic learning platforms incorporate some simple scheme for providing metadata about resources, course units and people.

Microwave link

Transmission technology using high-frequency radio signals that are sent and received between line-of-sight open-air antennas.

Modem

Short for modulator-demodulator, an electronic device which makes digital communication possible over analogue telephone lines by converting digital data to analogue form and back.

MPEG

The name of the standard used by software and hardware system designers to develop digital motion pictures, and associated soundtracks for the marketplace. Different standards are defined by MPEG-1, MPEG-2, etc.

Multicast

Transmitting information to a well-defined and controlled group of users on your network.

Multimedia

A work assembled using elements from more than one medium, such as images, sounds, video and text.

Netcast

Publicly broadcasting on the Internet usually with audio and video.

Netiquette

Internet etiquette. A set of informal rules governing how Internet users should behave.

Newsgroup

A subject-specific bulletin board-like discussion forum that can be accessed through the Internet.

Offline

Usually used in the context of ICT-supported learning to describe work or tools that are used to support work that is done when the user is not connected to the Internet.

Online

Connection to the Internet, or other such network service.

Operating System

A set of routines and programmes that control a system's resources and provide access to its services, e.g. Windows 95, Unix.

Optical fibre

An extremely thin, flexible thread of pure glass able to carry thousands of times more information than traditional copper wire.

PAL

Abbreviation for Phase Alternative Line System, the television video signal format used in most of Europe.

PBX

Private Branch Exchange: the telephone switchboard within your company or institution.

PDF

Portable Document Format, a product from Adobe that allows for the capturing and display of electronically created documents in exactly the same format and style as the one in which they were originally created.

Protocol

A definition or standard for the communication between equipment attached to a network, allowing different kinds of systems to interact.

Proxy server

A service providing a cache of items available on other servers, e.g. WWW pages. This makes it faster to retrieve items that have been accessed before.

PSTN

Public Switched Telephone Network describes the everyday telephone network used for the transmission of voice conversations, fax images and for low-speed data transmission. A PSTN network comprises the telephone equipment in homes and offices, the switching and multiplexing systems at exchanges and the trunk connections between exchanges.

QoS

Quality of Service in telecommunication terms means a guaranteed service offer, access and bandwidth.

QuickTime

A product from Apple that can run on all computers, and that is widely used to display digital audio, video and virtual reality programmes.

RSVP

(ReSource reserVation set-up Protocol) is an Internet protocol used by the host computer to require a specific quality of service (QoS) or dedicated bandwidth from a network, for a specific application data flow or stream. RSVP carries the host request via each node used to carry the data stream. At each individual node, RSVP makes a resource reservation for the stream.

Resolution

The number of pixels that can be displayed on a monitor, expressed as the number of horizontal pixels times the number of vertical pixels, e.g. 1024x768.

Rollabout
A large videoconferencing unit specifically built to be wheeled from one room into another (as distinct from a desktop that sits on the desk). In practice, they often stay in a dedicated videoconferencing room.

Router
A device that transparently connects Local Area Networks: it allows data to pass from one network to another in the most efficient manner.

RTF
Rich Text Format is a standard format for exchanging word processing files. RTF files can be opened by almost all word processors on any computer platform.

Search engine
A programme that allows users to enter keywords and be provided with links to materials on the Internet, intranet or single computer system.

Secam
Sequential Colour and Memory, the television video signal format used in France and parts of Eastern Europe.

Server
A computer or a programme that allows other computers, clients, to access the information stored on it over a computer network.

SMTP
Simple Mail Transfer Protocol is responsible for the transfer of mail across a network. SMTP is based on end-to-end delivery: SMTP systems will try to send the mail directly to the destination mail server, and keep on trying until it is successful.

Software
Computer programmes, as opposed to the physical components on which they run, the hardware.

Synchronous
At the same time, usually real time. In telecommunication context: data is transmitted in fixed-size blocks and the transmitter and receiver sequencing and timing is in synchronism, as opposed to asynchronous transmission.

TCP/IP
Abbreviation for Transfer Control Protocol over Internet Protocol, the term often refers to the larger set of protocols, the TCP/IP suite, used for transporting information on the Internet.

UNIX
A common name for a group of similar multi-user operating systems that are often used in larger organisations.

Uploading
Copying data from a remote computer to your computer over a computer network, the opposite of downloading.

URL
Abbreviation for Uniform Resource Locator, a standard for specifying the location of an object on the Internet and the way in which it can be accessed. The object can be for example a file or an HTML document. URLs are extensively used on the WWW.

Videoconference
An interactive two-way teleconference among people at remote locations by means of transmitted audio and video signals.

Videodisc

Videodisc is an optical device for the recording of audiovisual data (video and audio), also known as Laserdisc or LaserVision. Videodiscs are analogue storage media, comparable in quality to VHS videotapes. Depending on the format in which the videodisc is produced, videodisc can play back the video and audio in a linear or non-linear (interactive) way. Videodisc is being replaced more and more by CD-ROM and DVD, which allow for greater functionality, higher quality and better storage capacity.

Video-on-demand

Access to video programmes over telecommunications networks, when and where the user requires and requests them.

Virtual Reality

An artificial computer-generated environment, which is experienced through sensory stimuli and in which special equipment allows the user to interact with the simulation.

WAN

Abbreviation for Wide Area Network, a communications network that covers a large geographical area.

WWW

Abbreviation for World Wide Web, a client-server hypertext and hypermedia information retrieval system on the Internet that interconnects information around the world.

X-400

The ITU standard that describes how the electronic address of a user on a computer network should be constructed. Although this is the accepted standard, most users have adopted the more generic Internet or SMTP e-mail address format.

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As we face a revolutionary move towards e-learning and away from traditional face-to-face training, today's human resource manager implementing technology-supported training needs a concise, practical handbook outlining the choices that have to be made and the implications of each approach.

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Based on broad experience and peppered throughout with case studies and examples from leading European companies and institutions, it also offers plenty of background information including an overview of network options as well as a handy glossary and further resources list.

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